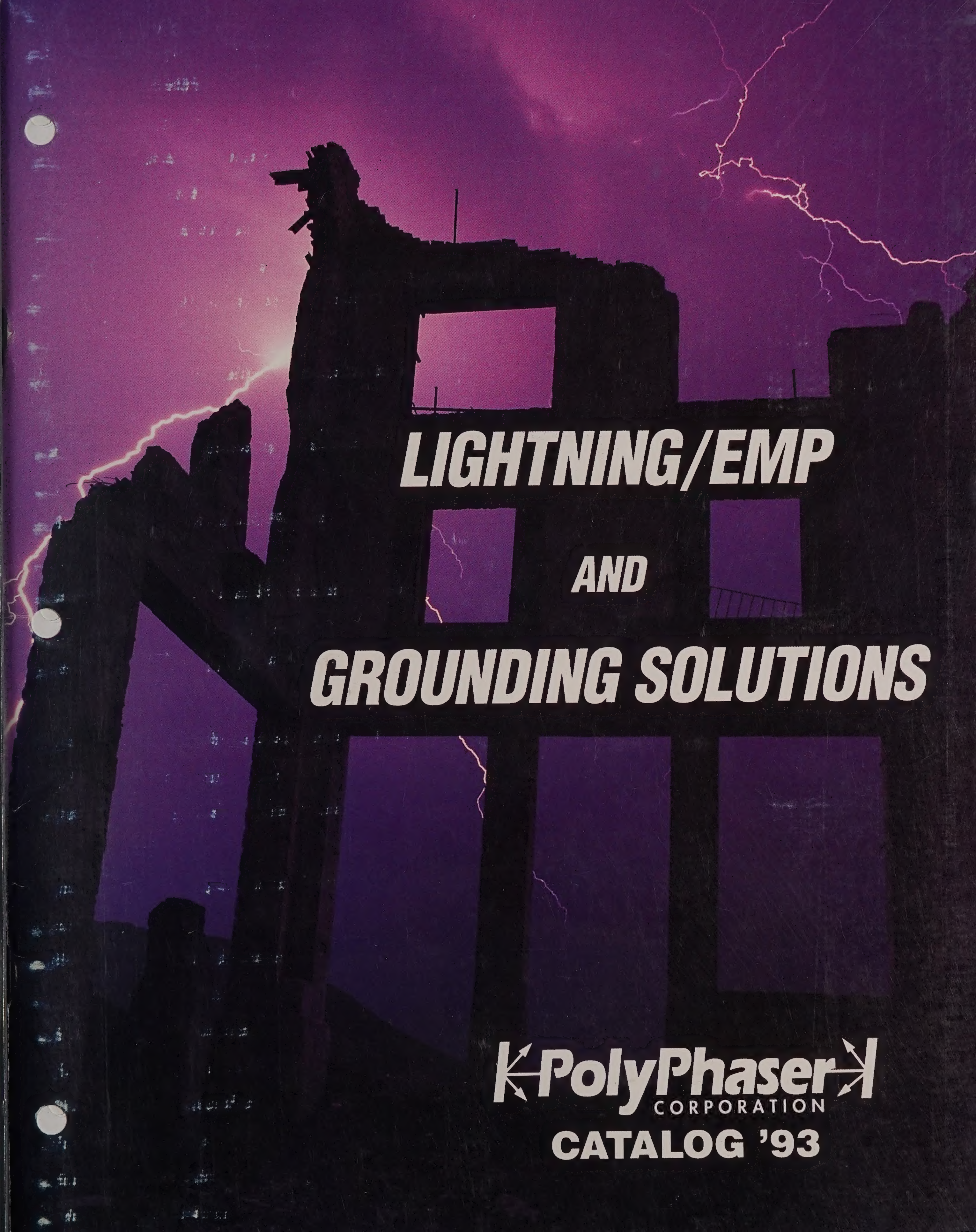

LIGHTNING/EMP

AND

GROUNDING SOLUTIONS

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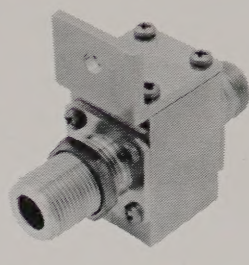
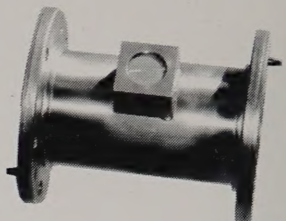
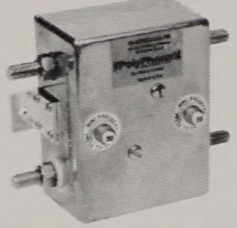
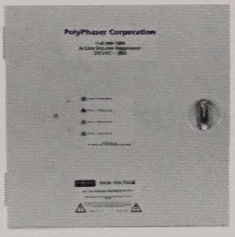
CATALOG '93

GROUNDING AND LIGHTNING SOLUTIONS

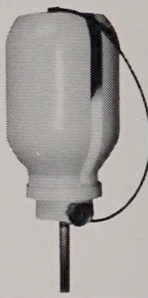

COAX TO 6GHz

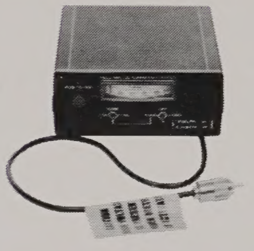

BROADCAST & MILITARY TO 80 KW

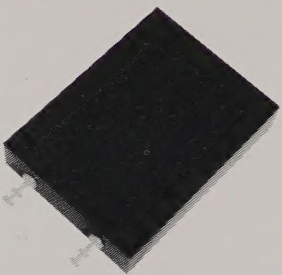

12-80VDC @ 50A

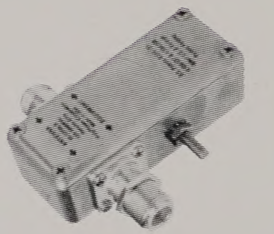

3ø POWER TO 480VAC

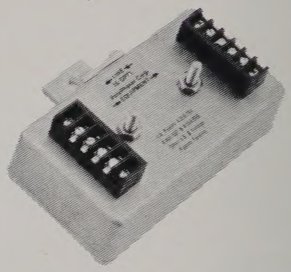
STRIKE COUNTERS TOWER/POWER/PHONE

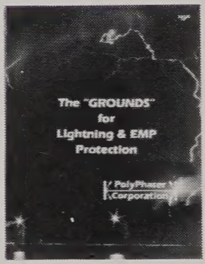

CHEMICAL GROUND SYSTEMS


BREAKDOWN TESTERS

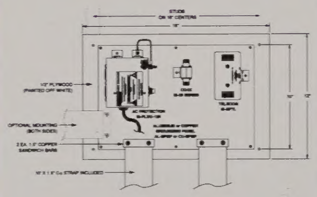

HIGH CURRENT/ENERGY LOW CAPACITANCE SHUNT

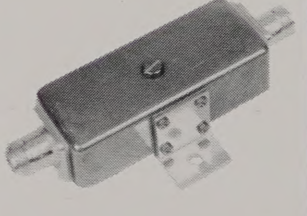

4-23 GHz MICROWAVE DOWNCONVERTERS

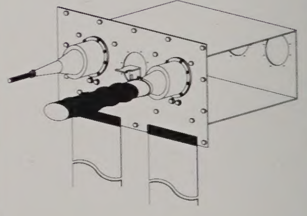

TWISTED PAIR (TO DS-3 RATES)

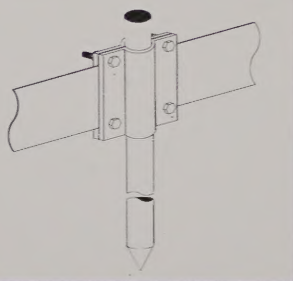


VIDEO & TUTORIAL BOOK


SINGLE POINT GROUND PANEL


LAN/VIDEO


ENTRANCE PANELS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Dealer Price List — Effective January 1, 1993

PAGE	MODEL NUMBER	Column 1	Column 2	Column 3
PART 1	***dc Type dc-700MHz***			
6,7	IS-50BB, IS-50NB, IS-50UB, IS-75BB, IS-75FB, IS-93BB	$ 52.95	$ 42.50	$ 38.25
8	IS-10KWLC	194.95	155.75	140.00
8	IS-10KW78E	204.95	164.00	147.75
9	HIGH POWER MILITARY & BROADCAST	Call Factory With Specifications		
PART 2	***dc Type with Isolated Shield dc-200MHz***			
10	IS-IE50BB, IS-IE50NB, IS-IE50UB, IS-IE75BB, IS-IE75FB, IS-IE93BB	94.95	76.00	68.50
PART 3	***dc Blocked .45-20GHz***			
11	IS-50UB-C	52.95	42.50	38.25
12, 13	IS-50UX-C0, IS-50UX-C1, IS-50NX-C0, IS-50NX-C1, IS-50NX-C2	52.95	42.50	38.25
12, 13	IS-75F-C1	44.95	36.00	32.50
14, 15	IS-B50LU-C0, IS-B50LU-C1, IS-B50LN-C0, IS-B50LN-C1, IS-B50LN-C2	59.95	48.00	43.25
14, 15	IS-B50HU-C0, IS-B50HU-C1, IS-B50LN-C0, IS-B50HN-C1, IS-B50HN-C2	64.95	52.00	46.75
16	IS-NEMP-C0, IS-NEMP-C1, IS-NEMP-C2	91.95	73.50	66.25
17	IS-MR50LN, IS-ML50LN, IS-MH50LN, IS-MT50LN	125.95	100.75	90.75
PART 4	***dc Blocked and Grounded 20-1000MHz***			
18	IS-LR50LU, IS-LR50LN, IS-GF50LU, IS-GF50LN	87.95	70.50	63.50
PART 5	***dc Injector/dc Path 1.5-20GHz***			
19	IS-MD50LNZ	87.95	70.50	63.50
20, 21	IS-DC50LN, IS-GC50LN, IS-DC50LNZ	87.95	70.50	63.50
22	IS-SB75F	58.95	47.25	42.75
22	IS-DB75F	63.95	51.25	46.25
PART 6	***Combiner Protectors 125-980MHz***			
23	IS-VU50HN, IS-CU50HN	141.95	113.50	102.25
24	IS-UT50HN, IS-UT50HN-B	121.95	97.50	87.75
25	IS-CT50HN, IS-CT50HN-B, IS-PT50HN, IS-PT50HN-B	103.95	83.25	75.00
25	IS-CT50HLC, IS-CT50H78E	194.95	155.75	140.00
PART 7	***RF Coupled Shield/dc Blocked 1.5-2600MHz***			
26, 27	IS-IE50LU-C0, IS-IE50LU-C1, IS-IE50LN-C0, IS-IE50LN-C1, IS-IE50LN-C2	99.95	80.00	72.00
26, 27	IS-IE50HU-C0, IS-IE50HU-C1, IS-IE50HN-C0, IS-IE50HN-C1, IS-IE50HN-C2	104.95	84.00	75.75
26, 27	IS-IEML50LN, IS-IEMH50LN	150.95	121.00	109.00

- $300.00 minimum factory order. Contact closest distributor. See insert.
- Prices shown F.O.B. Minden, Nevada
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  - — If your total is over $2350.00, you are eligible for the Column 3 price.
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- Prices subject to change without notice.

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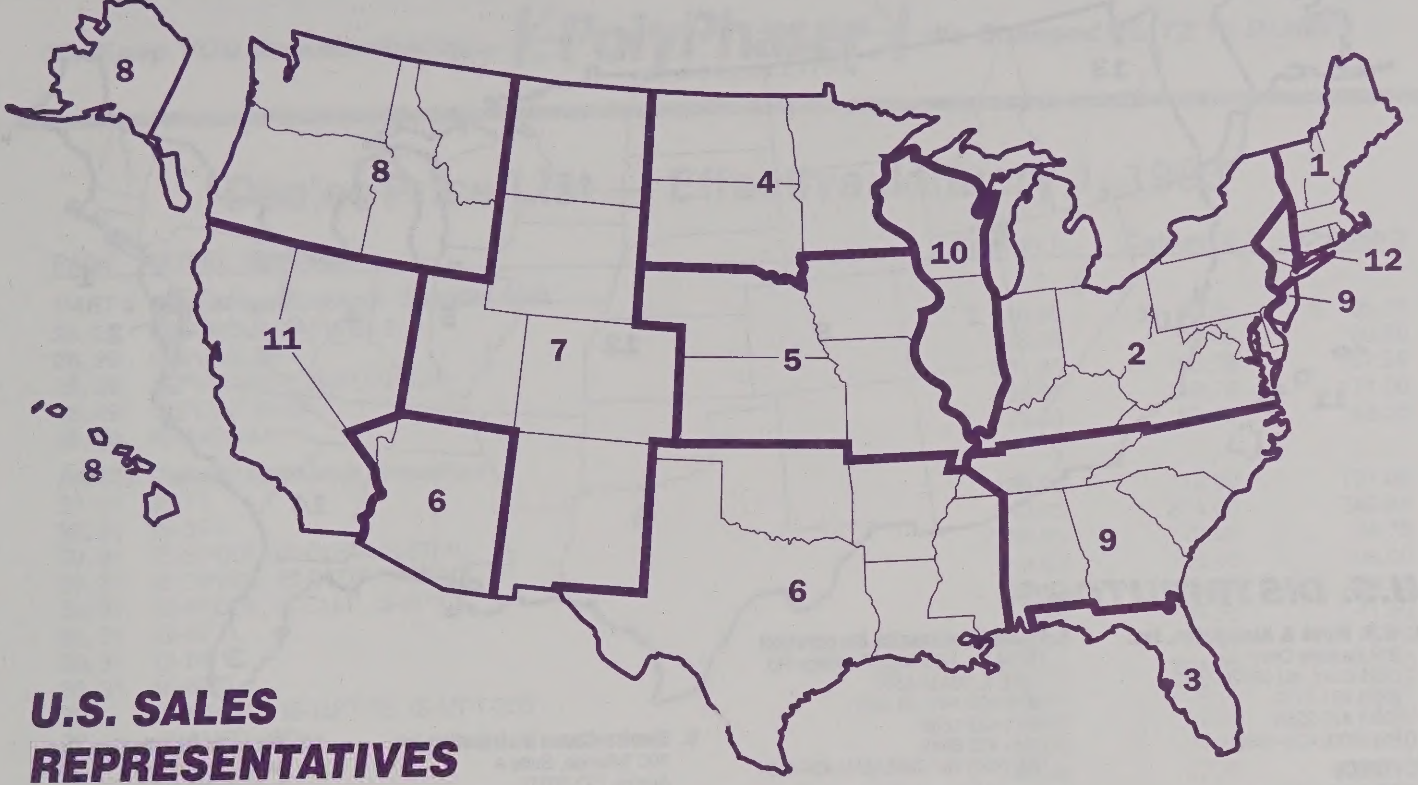

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3. **MAC COM, Inc.**
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9. **PolyPhaser Corporation**
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10. **Electronic Products Inc.**
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12. **PMC Associates**
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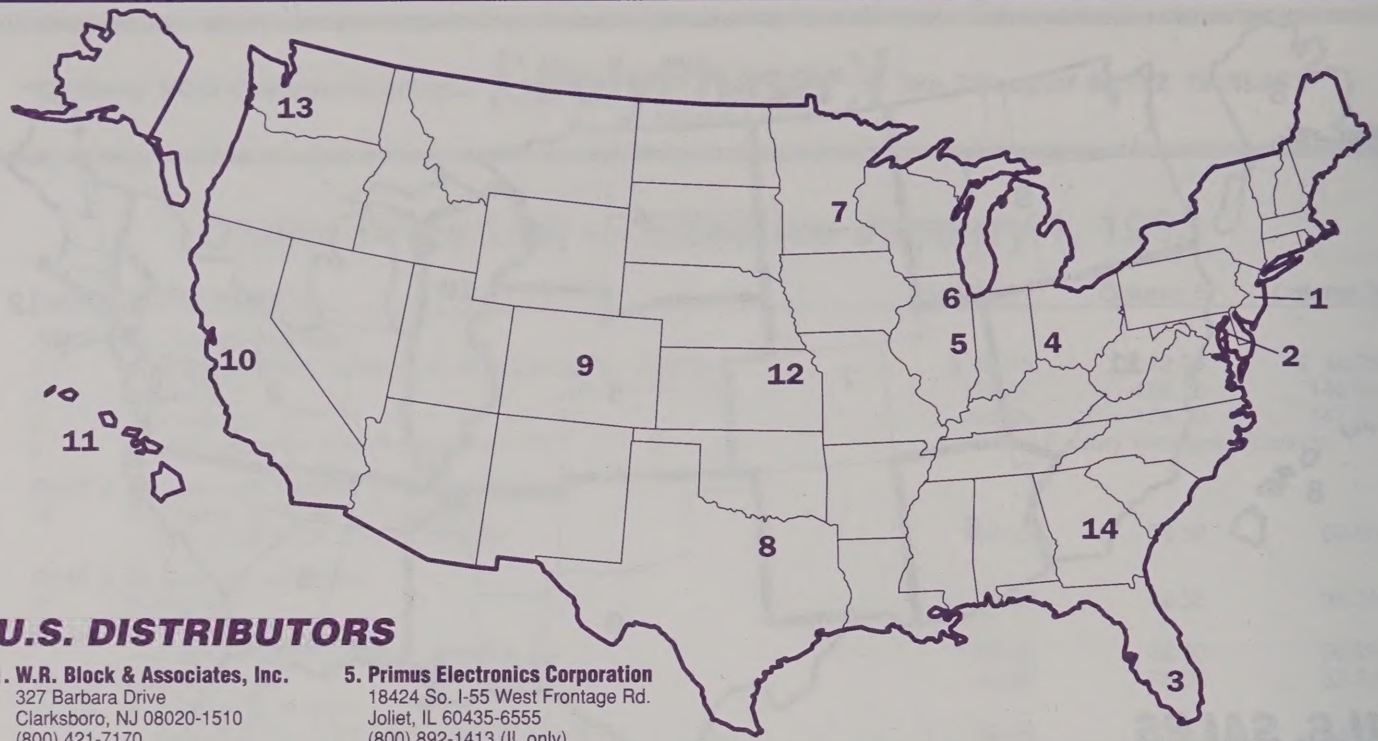

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7. Pulstar Distributing Inc.
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Dealer Price List — Effective January 1, 1993

PAGE	MODEL NUMBER	Column 1	Column 2	Column 3
PART 8	***Special Applications - Satellite Dish***			
28, 29	IS-TVRO-P, IS-TVRO-2	$ 118.95	$ 95.25	$ 85.75
28, 29	IS-TVRO-2P	123.95	99.25	89.50
28, 29	IS-PLTVRO-P, IS-PLTVRO-2	231.95	185.75	167.25
28, 29	IS-PLTVRO-2P	236.95	189.75	171.00
28, 29	IS-AM36V	73.95	59.25	53.25
PART 9	***Twisted Pair/Cable Protectors***			
30, 31	IS-T1	139.95	112.00	101.00
30, 31	IS-3T1	342.95	274.00	246.25
30, 31	IS-SPDDL, IS-CLSP, IS-SPXL	89.95	72.00	64.75
30, 31	IS-DPDDL, IS-CLDP, IS-DPXL	149.95	120.00	108.00
30, 31	IS-6PDDL, IS-CL6P, IS-6PXL	359.95	288.00	259.25
30, 31	IS-SPTL	57.95	46.25	41.50
30, 31	IS-DPTL	105.95	84.50	75.75
30, 31	IS-6PTL	255.95	204.25	183.50
32	IS-MPT-17, IS-MPT-75, IS-MPT-200	5.95	4.75	4.25
32	IS-AMPT-250	8.95	7.25	6.50
32	25P10GB	26.95	21.50	19.50
33	IS-RCT	46.95	37.75	34.00
33	IS-RCT-J1	49.95	40.00	36.00
33	IS-RCT-J2	52.95	42.25	38.00
PART 10	***dc Power Protectors***			
34	IS-(12, 17, 24, 35, 48)VDC-50A-(NG or PG)	149.95	120.00	108.00
34	IS-60VDC-50A-(NG or PG)	174.95	140.00	126.00
PART 11	***ac Power Protectors***			
35	IS-PLDO-120-15A	143.95	115.25	103.75
35	IS-PLDO-120-20A	179.95	144.00	130.00
35	IS-PLDO-240-20A	168.95	135.00	121.25
35	SIXPLEX	7.95	6.25	5.50
36	IS-MSRP-120-15A	156.95	125.75	113.25
38	IS-PM120-SP, IS-PM240-SP, IS-PM480-SP IS-PM120-BP, IS-PM240-BP, IS-PM480-BP	274.95	220.00	198.00
38	IS-PM208-3Y, IS-PM240-3D, IS-PM240-3O	288.95	231.25	208.25
38	IS-PM480-3Y, IS-PM480-3D, IS-PM480-3O	385.95	308.75	278.00
39	IS-IL120-SP-100A, IS-IL240-SP-100A, IS-IL480-SP-100A	749.95	600.00	540.00
39	IS-IL240-BP-100A, IS-IL480-BP-100A	749.95	600.00	540.00
39	IS-IL120-SP-200A, IS-IL240-SP-200A, IS-IL480-SP-200A	849.95	680.00	612.00
39	IS-IL240BP-200A, IS-IL480-BP-200A	849.95	680.00	612.00
39	IS-IL120-SP-400A, IS-IL240-SP-400A, IS-IL480-SP-400A	999.95	800.00	720.00
39	IS-IL240-BP-400A, IS-IL480-BP-400A	999.95	800.00	720.00
39	IS-IL208-3Y-100A, IS-IL240-3D-100A, IS-IL240-30-100A	949.95	760.00	684.00

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Dealer Price List — Effective January 1, 1993

PAGE	MODEL NUMBER	Column 1	Column 2	Column 3
PART 11 ac Power Protectors (continued)				
39	IS-IL480-3Y-100A, IS-IL480-3D-100A, IS-IL480-3O-100A	$ 949.95	$ 760.00	$ 684.00
39	IS-IL208-3Y-200A, IS-IL240-3D-200A, IS-IL240-3O-200A	1,049.95	840.00	712.00
39	IS-IL480-3Y-200A, IS-IL480-3D-200A, IS-IL480-3O-200A	1,049.95	840.00	712.00
39	IS-IL208-3Y-400A, IS-IL240-3D-400A, IS-IL240-3O-400A	1,199.95	960.00	864.00
39	IS-IL480-3Y-400A, IS-IL480-3D-400A, IS-IL480-3O-400A	1,199.95	960.00	864.00
PART 12 Component Protectors				
40	IS-PSP-120, IS-PSP-240	29.95	23.50	21.00
40	IS-7WFU	106.95	85.25	76.50
40	IS-12WFU	196.95	157.75	141.75
41	IS-LC200V625A SERIES	69.95	56.00	50.50
PART 13 Test Equipment				
42	F.I.S.T.-4	270.95	216.75	195.25
43	LSC-10, LSC-30	57.95	46.50	42.00
43	LSC-20	62.95	50.50	45.50
PART 14 Grounding Components				
44	1.5" STRAP (PER LINEAR FOOT)	.95	.75	.60
44	3.0" STRAP (PER LINEAR FOOT)	2.75	2.20	2.00
44	6.0" STRAP (PER LINEAR FOOT)	3.95	3.25	3.00
44	J-1	7.95	6.50	6.00
44	J-2	9.95	8.00	7.25
45	1C-112S, MSC-3	8.95	7.25	6.50
45	20C-112S, 58R-112S	10.95	9.00	8.25
45	TK-1, TK-2	3.95	3.25	3.00
45	TK-3, TK-4	6.95	5.50	5.00
46, 47	PR-4G, PR-4T	157.95	126.50	114.00
46, 47	PR-8G, PR-8T	169.95	136.00	122.50
46, 47	PRM-25EG, PRM-25ET	221.95	177.25	159.25
46, 47	PRM-OG, PRM-OT	325.95	260.50	234.00
46, 47	PR	10.95	9.00	8.25
46, 47	TDGR	145.95	116.75	105.25
48, 49	3PB	650.95	521.00	469.00
48, 49	5PB	749.95	600.00	540.00
48, 49	8PB	874.95	700.00	630.00
48, 49	10PB	974.95	780.00	702.00
48, 49	16PB	1,174.95	940.00	846.00
48, 49	24PB	1,623.95	1,300.00	1,170.00
50	AL-SPGP, CU-SPGP	52.95	42.50	38.25
50	WK-1	2.95	2.50	2.25
PART 15 Educational Materials				
51	GROUNDING - AN OVERVIEW	49.95	40.00	36.00
51	SGS	7.95	5.75	5.00
51	GLEP	22.95	18.50	16.75

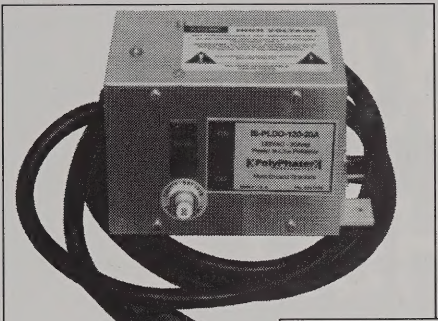
- $300.00 minimum factory order. Contact closest distributor. See catalog insert.
- Prices shown F.O.B. Minden, Nevada
- To determine your price, total your order using Column 1:
  - — If your total is between $.01 and $300.00, you are eligible for the Column 1 price. Contact closest distributor. See catalog insert.
  - — If your total is between $300.00 and $2350.00, you are eligible for the Column 2 price.
  - — If your total is over $2350.00, you are eligible for the Column 3 price.
- Female to female connectors are standard on all units. Male connectors can be provided if indicated in catalog at an additional $10.00 for UHF males $5.00 for all other male connectors. Add suffix -MA for male on antenna port, -ME for male on equipment port.
- Prices subject to change without notice.

POWER LINE PROTECTORS

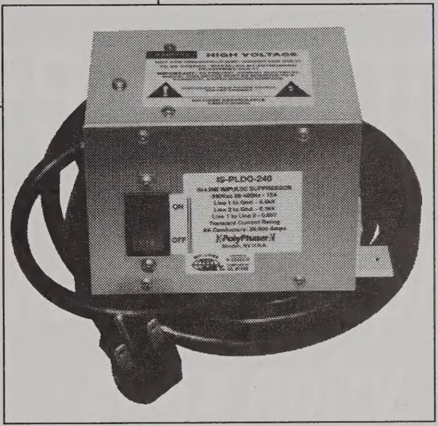
PolyPhaser's new 20 amp-120Vac and 15 amp-240Vac Power Line protectors with Duplex Outlet are NRTL approved and available now. These units have 20kA surge capability with EMI filtering. Quality built using the crimped and soldered technique with silver content solder, these protectors have our 10 year warranty.

Order models:

IS-PLDO-120-20A
IS-PLDO-240-15A



IS-PLDO-120-20A



IS-PLDO-240-15A

STRIKING NEWS

PolyPhaser's *"Striking News"* is truly a tutorial newsletter. Fine articles on grounding and shielding are just a few of the many topics that are covered in the 8 page publication. The latest PolyPhaser scientific finds on lightning, gounding and protection will be first published here. Free to all PolyPhaser customers, it is mailed worldwide and is published, in English, several times a year.

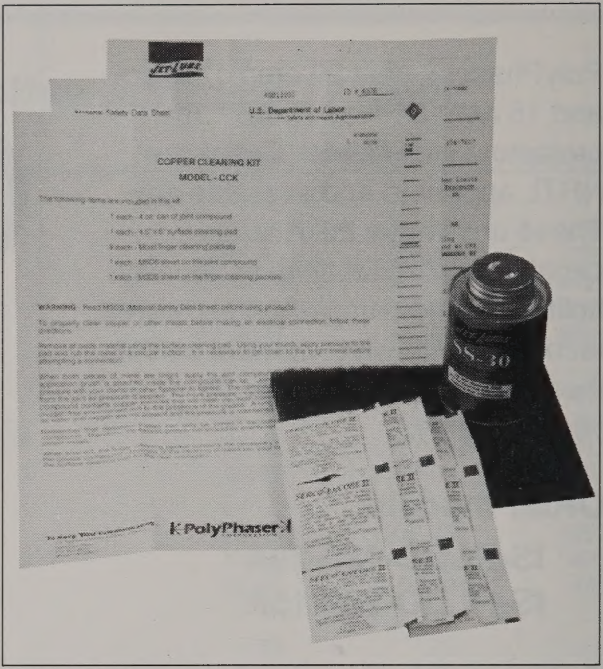
Contact: PolyPhaser

Striking News From PolyPhaser
Nevada Senator Br Asks Questions
Striking News From PolyPhaser
Lightning Caused by Volcanoes
Big Bertha
Increased Power for Trunking Combiner Series
Video Series Initiated
Ufer and Tower Grounding

COPPER CLEANING KIT

PolyPhaser's new Copper Cleaning Kit (CCK) provides a means to clean copper and also contains 4 ozs. of copper joint compound to weather seal connections from moisture and corrosion. Complete with finger towelettes for clean up, the CCK has instructions and MSDS safety sheets. The CCK is included in each PolyPhaser bulkhead panel entry system, but can also be purchased separately.

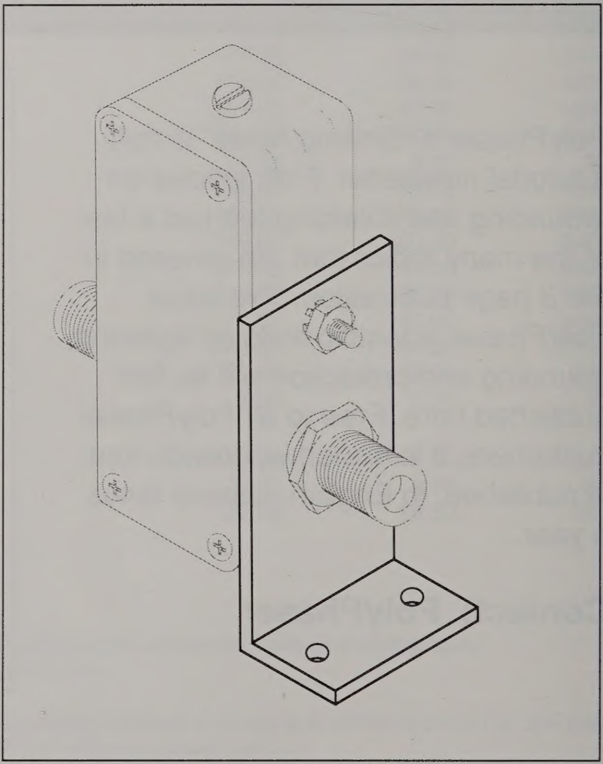
Order model: CCK



BF ADAPTER

To adapt any PolyPhaser bulkhead mountable protector to a single point grounding panel or other flat surface, the BF adapter will provide a good low inductance, large surface area connection. Basically designed for female connectors, the BF adapter will handle all bulkhead protectors.

Order model: BF adapter



MAXIMUM LIGHTNING PROTECTION

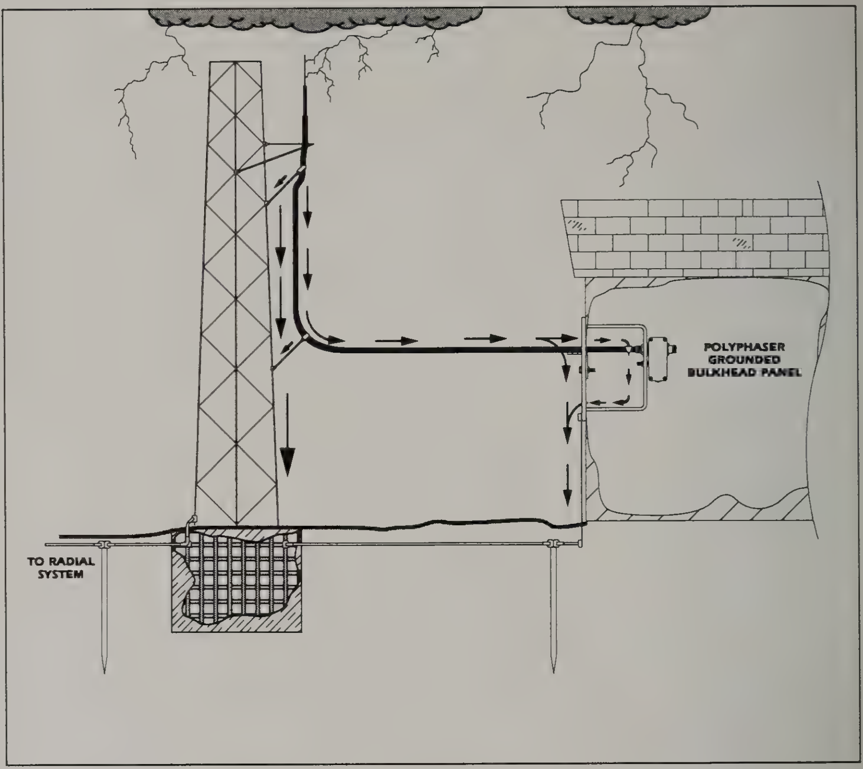
The first complete coax entry protection system

- ► Low inductance grounding design for shields & protectors
- ► All copper with stainless steel hardware

PolyPhaser CORPORATION ®

When lightning strikes, it is important to divert as much strike energy to ground as possible!

Multiple ground paths are established by using coax grounding kits at the top, along the tower and at the tower base. The most important kit is the bottom tower base location. The best means to further reduce the coax strike energy from entering the equipment hut is to provide an additional path to ground prior to cable entry. Since 50% of this energy is on the center conductor, a coaxial protector will be needed to protect the equipment. This too must be grounded in a low inductance fashion. PolyPhaser's copper bulkhead entrance panel kit uses mulitiple 6" wide copper straps to provide a low inductance path to ground. The bulkhead gives proper mounting/grounding for both the coax shields and PolyPhaser's coax protectors while insuring weather tight cable penetrations.

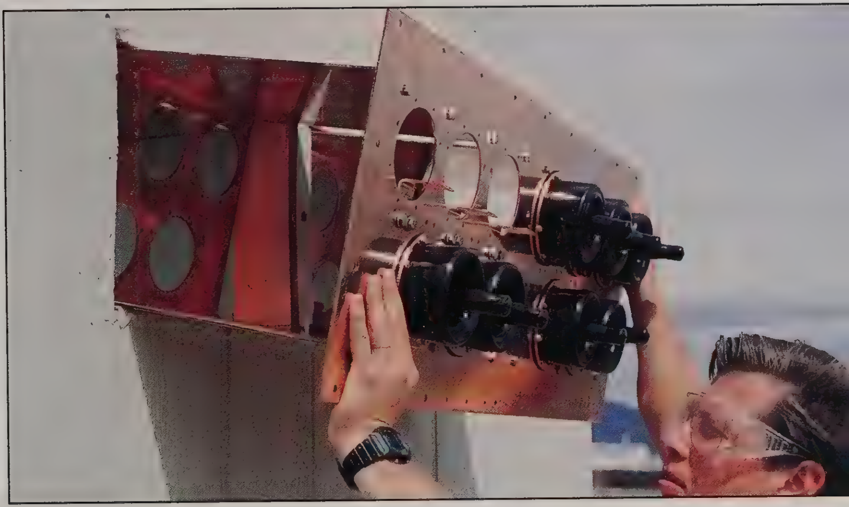


PolyPhaser's coax entry system is the last line of defense between a lightning strike and your equipment.

- Bulkhead system is a complete easy to assemble kit
- Available in 3, 5, 8 10, 16 and 24 ports
- Typical installation time - under 2 hours for a 10 port panel

- Designed for long life
- No oxidation or corrosion ground paths
- All strike current connections use joint compound
- Joint compound included in Copper Cleaning Kit (CCK). (CCK is also available separately)

- 3 port fits in place of a standard concrete block
- 3, 5 & 8 port fit between 16"o.c. studs
- Larger 10, 16 & 24 port panels straddle 16" center stud
- No additional framing needed

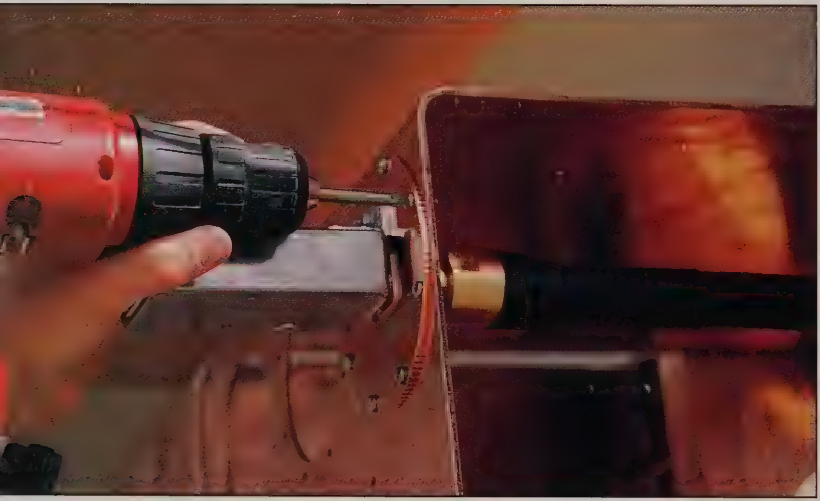


- Weather protected cable grounding finger fits 1/2" to 3-1/8" cables
- External grounding kits not required

- Cone shapped EPDM material weather boots
- Handles -60F to +300F, UV and Ozone stable
- One size fits all - scissor cut to cable size
- Boots expand 200% to fit over cable connectors
- Copper ring insures watertight fit

- Low inductance copper ground straps provide an easy method of grounding the entrance panel

- Buried strap sandwich bar bonds to ground system
- Bolt or exothermic weld



- Inside - Coax protector mounting disks
- Universal male/female UHF/N hole pattern
- Other connector/EIA flange hole patterns available
- No disk needed for waveguide

Order:

3PB	3 port entrance system
5PB	5 port entrance system
8PB	8 port entrance system
10PB	10 port entrance system
16PB	16 port entrance system
24PB	24 port entrance system

1500 models of coax, power and twisted pair protectors ... plus lightning/EMP and grounding solutions.

PolyPhaser
CORPORATION ®

(800) 325-7170 ■ (702) 782-2511 ■ FAX: (702) 782-4476
2225 Park Place ■ P.O. Box 9000 ■ Minden, NV 89423-9000

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Cover photo by Richard Stephens
Printed in USA
1/93

How to use this catalog.

There are many similarities between Lightning and EMP protection. Everyone has experienced lightning, but few know what is meant by EMP. EMP (Electro Magnetic Pulse) is a radiated electromagnetic broadband pulse which has a very high energy content. It is generated from the detonation of a nuclear weapon. If this occurs at a high elevation, the interaction of the weapon's radiation with the upper atmosphere (partial vacuum) will cause a larger area radiation/propagation of this pulse than if it were a surface detonation. A surface event will have a faster rise time pulse but will affect a more local area due to the earth's curvature. The radiated radio frequency pulse energy will be intercepted by any and all conductors and transformed into a voltage. Power lines, telephone lines and antennas will capture enough energy to cause equipment failure. Protection of your equipment is a must for both EMP and lightning. You can use similar type protectors. The difference is in the rise time of the events. EMP is in the low nanosecond range while lightning, at its fastest, is at least ten times slower. Protectors that are usable for EMP will work fine for lightning. They cost more and will *not* be that much better for lightning protection.

The concept of lightning protection can be summed up in a few words: You have control over the lightning strike's energy, not Mother Nature. This means that you are providing a path to earth and not allowing it to choose a random path. It is not possible to stop a strike, nor is it possible to prevent a strike from occurring. Therefore you must be prepared to divert the strike energy to earth via a deliberate and controlled path so that no damage will be incurred. Building or structure protection is more forgiving than protection of electronics. A building can handle 100,000 volts while electronics will be damaged with just a few volts.

There are but a few basic questions whose answers will determine the type of protector that you will need to keep your equipment protected from Nature's worst storms. These questions are highlighted here as sub-titles.

COAX PROTECTION

IMPEDANCE. 50, 75 and 93 ohm protectors are available. Most all the applications will be for 50 ohms.

SPEED. Is the protection for lightning only or lightning and NEMP (Nuclear Electro Magnetic Pulse) threats. Most of the protectors do well for both but for some military applications, high speed protection may be necessary. Special in-house gas tubes are used. Testing with our special rise time tester at 2kV/ns can supply results to 5kV.

FREQUENCY RANGE. There are broad coverage units (dc to 1.5 GHz specials) to single frequency filtered models. Generally, we can make units to 6 GHz. Most of lightning's energy is in the lower frequency range of dc to 1 MHz. The further away from this range, the less the amount of energy that will get through to the equipment (throughput energy). Always choose the lowest throughput energy for the desired frequency range.

TRANSMIT (XMIT) TRANSCEIVE (XCV) OR RECEIVE ONLY (RO). RO units with sensitive GaAs Fet preamps are listed. The number of XMIT signals is important. Protectors are voltage sensitive and multi-XMIT signals are voltage additive, not power additive. Two 100 watt XMIT signals combined equal 200 watts of heating power but the additive voltages have peaks of 200 V, which equate to a single 400 watt signal. Therefore, multi-channel simultaneous XMIT systems must have a higher turn-on voltage and be designed to handle the peak instantaneous RF currents which can be reached. These are listed for this usage in the catalog under "COMBINER PROTECTORS - Part 6."

TRANSMIT POWER. Units to 80 kW are listed for broadcast. Each model that can support a 10 watt or higher level is listed as to its power level capability. Generally, as the frequency is increased, the power handling is reduced. This is done for many reasons. The most important of which is to be sure the protector will turn-off after a lightning or NEMP firing and not be "kept alive" in a glow mode by the presence of the RF transmit energy. The turn on voltage is tied in with power handling. But since most of our units do not have dc continuity, little protection is lost by going to a higher turn-on voltage unit especially if XMIT combining is planned in the future. Note: Some models such as the IS-CT50HN (800-900 MHz multi-channel) have a higher turn on voltage than an IS-B50LN (125-1000 MHz. single channel XMIT) but have a much lower throughput energy (10 µJ vs. 600 µJ). This makes the IS-CT50HN excellent for RO.

PRESENCE OF AC OR DC POWER WITH THE RF SIGNALS. This is usually for RO situations such as tower top preamps. However, we have made units (specials) for the 800-900 MHz and in the microwave range for the higher current requirements of tower top transmit amplifiers. Units are listed for dc injector/pickoff and for protecting already injected coax lines (pickor model).

MOUNTING. Bulkhead panels are recommended. (Bulkhead panel systems are listed as auxiliary equipment.) Flange style may be mounted on a bus bar or our new single point ground panel shown on Page 50. A ground strap larger than the total sum of all the circumferences of the coax shields should be used to connect to a low inductance (Z) ground system. For more on grounding, see our listed book, "The 'Grounds' for Lightning & EMP Protection".

CONNECTOR TYPE AND SEX. UHF style connectors are poor at the UHF frequencies (300-3000 MHz). Watt meters that use these connectors will give misleading readings even with type N adaptors at the UHF bands. Type N connectors are recommended even though they have limited center pin lightning current handling compared to the UHF connectors. BNC, SMA and F male and female are stocked connectors. These and others are available for some models but will incur an additional cost. The connector sex can be chosen for male and/or female combinations (except some microwave models). Some models are factory stock. The male is always the one with the outside moveable shell and center pin. (See inside back cover for connector pictorials.)

DATA/PHONE LINE PROTECTION

For lightning, twisted pair cable bundles will mutually couple surge energy to all pairs. Unused pairs should be grounded (if allowed). For bundles over 6 pair, our IS-MPT Series should be used on 66 type punch down blocks with an appropriate grounding bus as described on Page 32. For 6 pairs or less, more energy will be present per pair so a hybrid protector, as shown on Page 30-31, can handle energy levels which will vaporize standard 24 AWG wire pairs.

For EMP, all of the listed twisted pair protectors will limit an EMP pulse to the "Surge Let Through Voltage Equipment Side" listing. Special bulkhead models are available for screen room penetrations in the single and dual pair configurations.

Selection of data/phone line protectors depends on the presence of either -48 V battery and/or ringing voltages. The line impedance and total allowable loop resistance and highest frequency or bit rate will determine the insertion loss from the protector's line resistance/inductance and capacitance. You may call for further assistance.

POWER LINE PROTECTION

For lightning and EMP, shunt type protectors will limit the voltages to a safe level for most non-electronic equipment. In-line type protectors are mandatory for electronic equipment survival. These in-line units should be mounted/grounded close to the equipment. For mainframe computers and broadcast equipment, in-line power mains protectors are listed which provide single or poly-phase protection with EMI/RFI filtering. Each have front panel status lights and local/remote alarm contacts as standard equipment.

For power line protector selection, the voltages, number of phases, configuration, and for in-line, current usage, will pinpoint the model. Voltages to 480 Vac are listed for single to three phase applications. All models (except IS-PSP-120 and IS-PSP-240) have built in end-of-life protection. Replacement modules and breakers are sold separately for most models.

GROUNDING

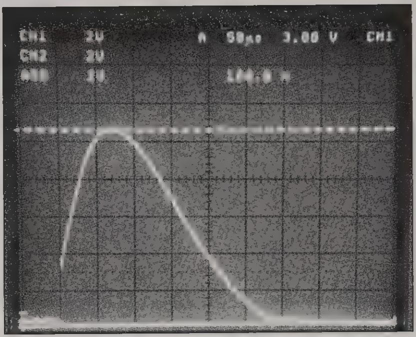
Grounding is so important that we wrote a book about it titled "The 'Grounds' for Lightning & EMP Protection". Also, video tapes on this and other protection/ installation subjects are now available in VHS format. Our unique PolyRod, chemical ground rod, can be used indoors with a domestic water source or outdoors to establish a low Z ground system. For more on grounding please see the appendix.

The need for protection.

Skin effect is a physical phenomenon that relates to the limited penetration into a conductor of an RF signal according to its frequency. Coax uses this effect to keep the RF signal inside and any coupled outside interference on its shield's outside surface. This begins to fall apart as the frequency is lowered and the penetration, which is a gradient, begins to mix the shield's outside interference energy with the desired inside energy. A ground loop, which imparts 60 Hz onto a desired signal, is due to dissimilar grounds causing ac current flow between points via the coax shield.

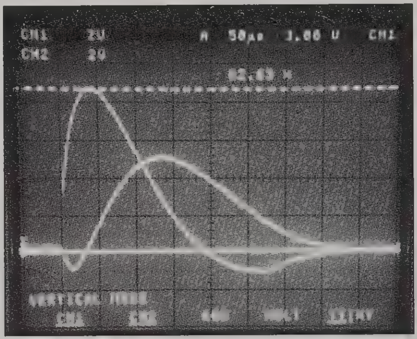
With lightning, the main frequency range is dc to about 1 MHz or so. This is right in the range that effects the coax and is called transfer impedance. The thicker the shield material, the less the effect of these low frequency currents. (Also the less the bending radius and the harder it is to work with.)

A test was performed on 51 feet of 1/2" hard line, where we shorted the center conductor to the shield on one end simulating a shunt-fed antenna. 1050 amperes of current was pulsed to individual .01 ohm resistors at the far end. These current viewing resistors went to separate channels on a digital storage scope. The most obvious result was that the velocity factor of the shield was such that the pulse arrived first. The center conductor had more inductance so the pulse was spread out in time. The energy (area under the curves) was exactly the same for both the shield and the center conductor. Since the pulses arrived at different times, a differential voltage occurred that must be equalized and prevented from reaching your equipment. This is precisely what the patented PolyPhaser products do in order to provide the ultimate protection.

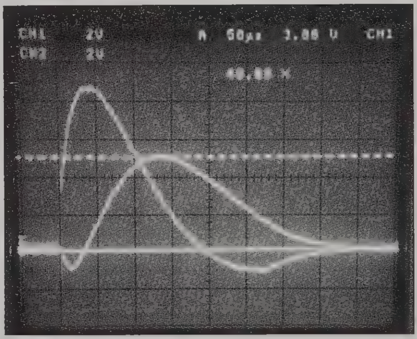


The above pulse was used on a 51 foot long 1/2" hard line. One end was shorted to simulate a shunt-fed antenna, while the other end went to separate .01 ohm current viewing resistors.

NOTE: This pulse is the algebraic summation and its peak 1050 Amps is referenced to 100%.



SHIELD
The voltage across each .01 ohm resistor. Here the shield has 82.63% relative to the total pulse.



CENTER
Here the center conductor's peak is only 48.89% of the total. Note that the area under both waveforms is nearly equal. Each has 50% of the total surge energy.

There IS a difference.

PolyPhaser Corporation's Impulse Suppressor Family is like no other EMP or Lightning Arrestor. Aside from the fact that a hermetically sealed voltage sensitive gas tube is used on most models, additional components assure that surge voltages and currents that form differentially on the coax are prevented from being shared by your equipment. By this we mean that other arrestors that have dc continuity through their centerpins, cannot function properly on equipment that have inductors to ground. Even at HF (1-30 MHz) frequencies, an inductor to ground may have a large enough value so that the L di/dt voltage drop, may be over the gas tube threshold, but will the coil wire be capable of withstanding the voltage, current and magnetic fields under these conditions? PolyPhaser's Impulse Suppressors have no dc continuity and thus does not share the surge with your equipment.

All gas tubes have a turn-on time. A gas tube's dc turn-on voltage is always lower than the dynamic turn-on voltage. It is the voltage wavefront that occurs before the crowbarring of the gas tube that reaches the equipment on these "dc continuity" type arrestors. This voltage can puncture through the dc blocking caps used on low voltage solid state equipment and cause damage. PolyPhaser's impulse suppressors use internal capacitors that have a dc working voltage that is two to three times the dynamic turn-on voltages of its gas tube. If the arrestor is triggered, due to a lightning strike or from wind blown static build-up, while RF transmissions are occurring, the gas tube must fire and extinguish properly. The RF may keep the gas excited (glow mode) thus causing a loss of transmit power and the generation of wide band noise. It is the choice of gas tube, that makes the difference. Not all gas tubes are the same! There are many variables; such as atmosphere gas mixture, gas pressure, gap geometry, gap distance, carbon striping, electrode alloy make-up, and electrode coatings. All of these variables go into a balance between turn-on voltage, turn-on time, current handling capability, lifetime as well as extinguishing capability in the presence of RF.

PolyPhaser's patented models all have specifications as to their power handling limits to insure proper turn-off. To do this, you may see that our dc turn-on voltage is higher than most, but since we don't share the surge energy, the turn-on threshold has little to do with the amount of protection given to the equipment. We are proud to specify the small amount of left over throughput energy that will reach the equipment. *No one else does, or can!*

Many have asked why the gas tubes are not replaceable on a PolyPhaser®. The reasons are many and go back to a quality issue. If an Impulse Suppressor must handle a 50,000+ ampere strike, the gas tube to body connection must not arc and spark like some connector manufacturer's protectors. The oxidation that occurs to exposed parts as well as the human skin oils that can be imparted onto a removeable gas tube will only add to the time and voltage that will be seen through a dc type protector. For PolyPhaser's non-dc type protectors this is not so important as is the mere thought that a failure could occur. If someone inadvertently forgets to replace the gas tube, damage will occur to the protector and even the equipment. Since a PolyPhaser® also consists of other protective components, the lack of the gas tube may also damage or partially damage these components as well. This may also cause a future failure in protecting a sensitive piece of equipment. It is this regard for quality, to ensure that a PolyPhaser® works properly every time, that we think is most important. Our warranty of 10 years, shows that we know how reliable our products are and are willing to stand behind them.

PART 1 dc type dc-30MHz

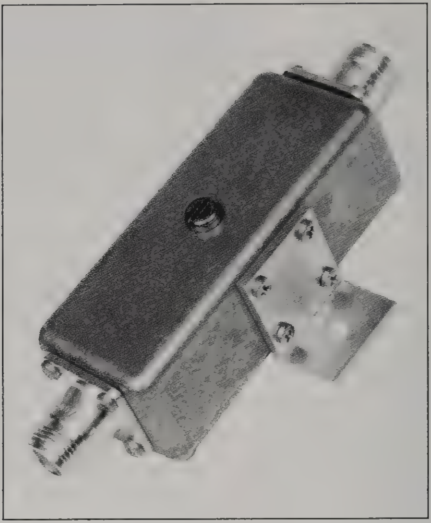
50/75/93 OHM BASEBAND COAXIAL PROTECTORS - FLANGE MOUNT

APPLICATION:
HF receive, LAN, closed circuit video, data.

- ☐ Bi-directional signals/protection
- ☐ Broadband-low VSWR and loss
- ☐ Multi-strike capability
- ☐ Low voltage thresholds
- ☐ Low throughput energy
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware

OPTIONS AVAILABLE:
1.5, 18, 24, 32 volt thresholds all models, watertight 50 and 75 ohms models only, Bulkhead version available, VSWR and IL plots

MIL SPECS:
Mil-STD-202 107F Cond.B -65°C to 125°C, Op to 70,000'; N Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365; Solder QQ-S-571 Sn62, follows Mil-STD-454J



Model shown IS-50NB

MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Frequency Range:
dc to 30MHz 50 ohm models
dc to 15MHz 75 ohm models
dc to 20MHz 93 ohm models

Turn-on:
±7Vdc ±20%

Turn-on Time:
4ns for 2kV/ns

Impedance:	Model:	Connectors
50 ohms	IS-50	BNC, UHF, N
75 ohms	IS-75	BNC, F
93 ohms	IS-93	BNC

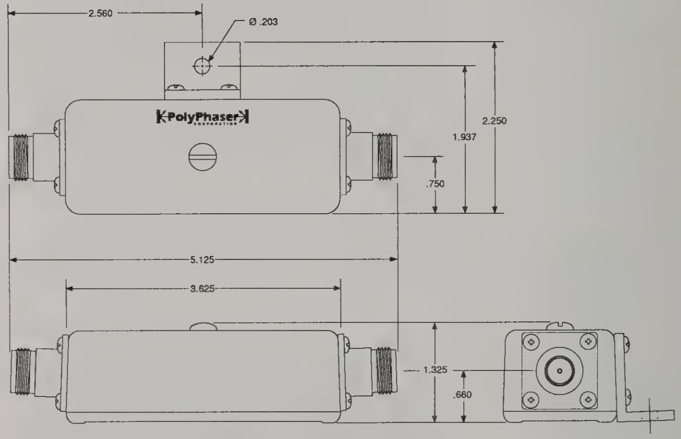
VSWR:
<1.1 to 1 over frequency range

Insertion Loss:
≤0.3dB over frequency range

Throughput Energy:
≤16μJ for 1kV/ns waveform

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

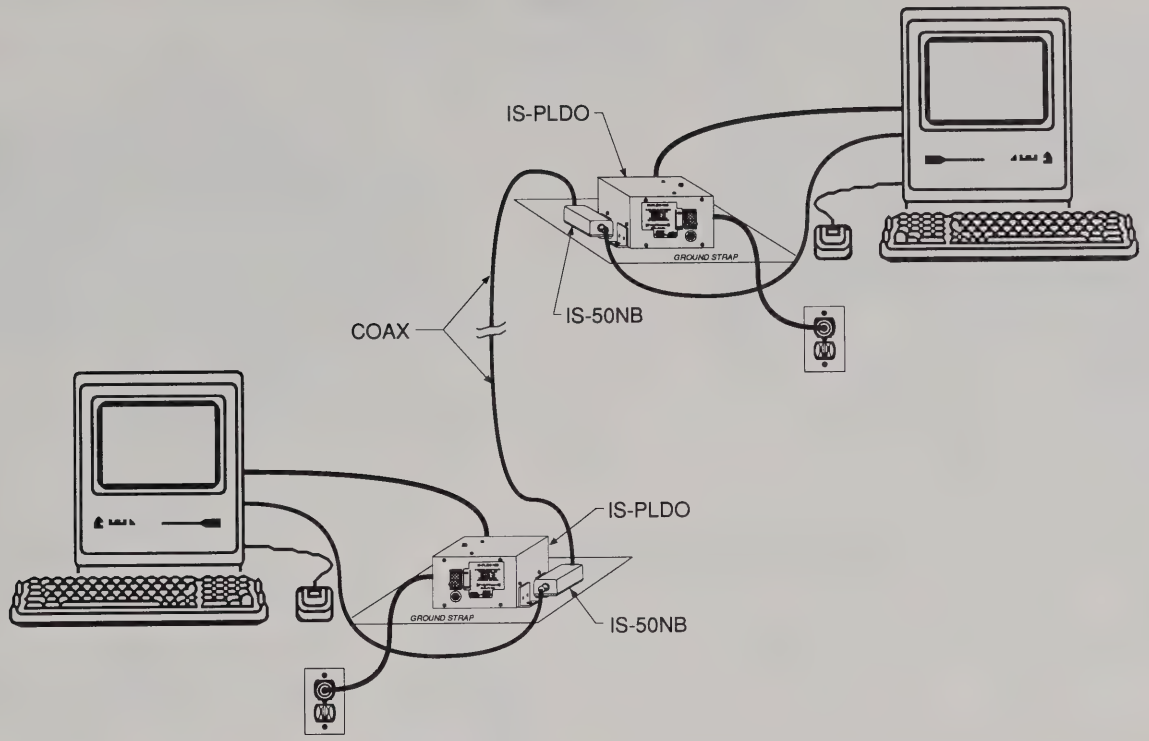


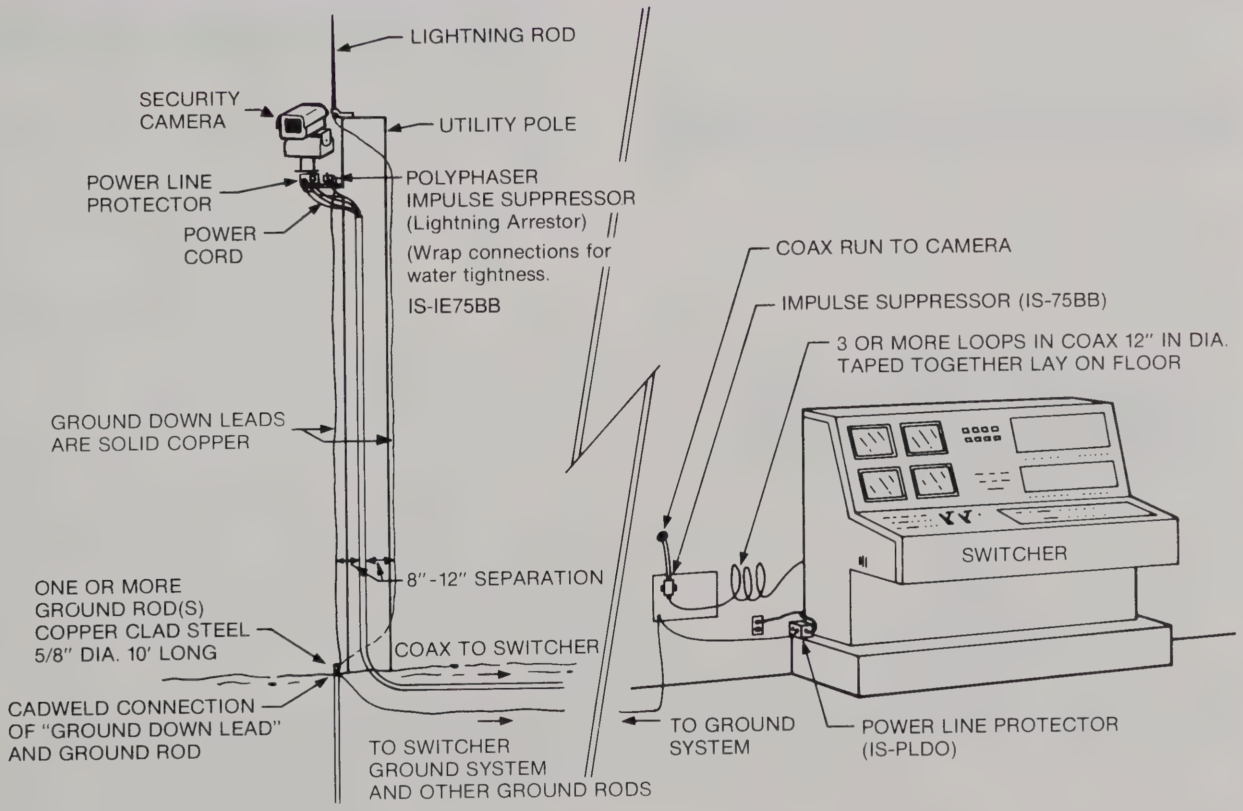
Order: Impulse Suppressor-ohms, connector, Baseband

IS-50BB	50Ω BNC females
IS-50NB	50Ω N females
IS-50UB	50Ω UHF females
IS-75BB	75Ω BNC(50Ω) females
IS-75FB	75Ω F females
IS-93BB	93Ω BNC(50Ω) females

Add suffix to any model: **-MA** for a male connector
Add $5.00 for each N or BNC male
Add $10.00 for each UHF male

50/75/93 OHM BASEBAND COAXIAL PROTECTORS - FLANGE MOUNT



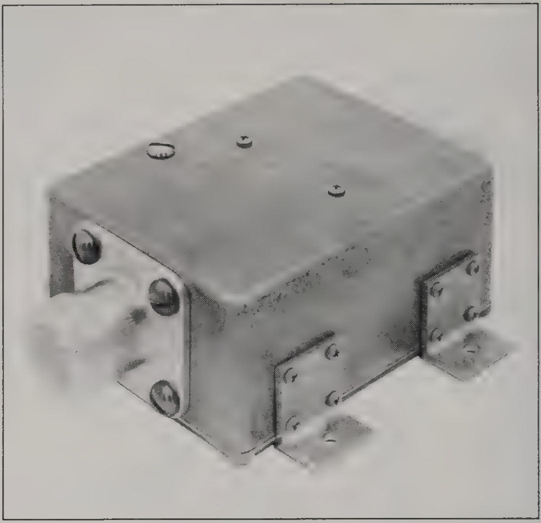

LIGHTNING ROD
SECURITY CAMERA
UTILITY POLE
POWER LINE PROTECTOR
POLYPHASER IMPULSE SUPPRESSOR (Lightning Arrestor)
POWER CORD
(Wrap connections for water tightness.
IS-IE75BB
COAX RUN TO CAMERA
IMPULSE SUPPRESSOR (IS-75BB)
3 OR MORE LOOPS IN COAX 12" IN DIA. TAPED TOGETHER LAY ON FLOOR
GROUND DOWN LEADS ARE SOLID COPPER
SWITCHER
8"-12" SEPARATION
ONE OR MORE GROUND ROD(S) COPPER CLAD STEEL 5/8" DIA. 10' LONG
COAX TO SWITCHER
CADWELD CONNECTION OF "GROUND DOWN LEAD" AND GROUND ROD
TO SWITCHER GROUND SYSTEM AND OTHER GROUND RODS
TO GROUND SYSTEM
POWER LINE PROTECTOR (IS-PLDO)

MEDIUM POWER LC AND 7/8" EIA COAXIAL PROTECTORS - FLANGE MOUNT

APPLICATION:

Medium power HF/VHF and FM broadcast.

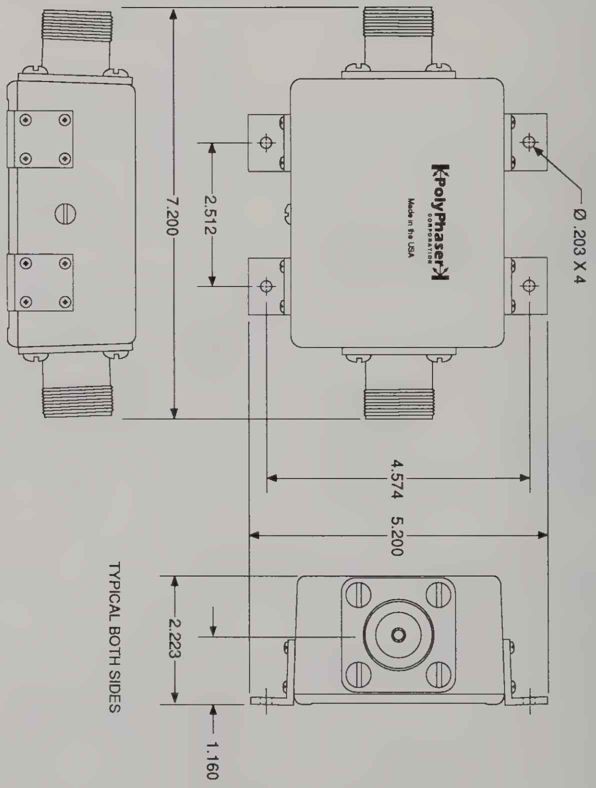
- ☐ Dc to 300MHz
- ☐ 10kW for dc to 50 MHz
- ☐ 5kW for 88 to 300MHz
- ☐ LC or 7/8" EIA
- ☐ Multi-strike
- ☐ 50kA 8/20 capability
- ☐ Housed use only
- ☐ 7/8" EIA is not air tight
- ☐ Bulkhead version available
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ LC silver shell, silver center, TFE
- ☐ 7/8" EIA must use Andrew Corp. 34389A bullets



Model shown IS-10KWLC
available in LC and 7/8" connectors

OPTIONS AVAILABLE:
Higher frequency range available configuration may change, 7/8" center bullets available, VSWR and IL plots

MIL SPECS:
Mil-STD-202 107F Cond.B -65°C to 125°C, Op to 70,000'; Connectors meet Mil-C-39012, QQ-S-365, QQ-C-530, Solder QQ-S-571 Sn62, follows Mil-STD-454J



MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

Turn-on:
2400 Vdc ±20%

Turn-on Time:
<30ns for 2kV/ns

Frequency Range:
dc to 300MHz

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

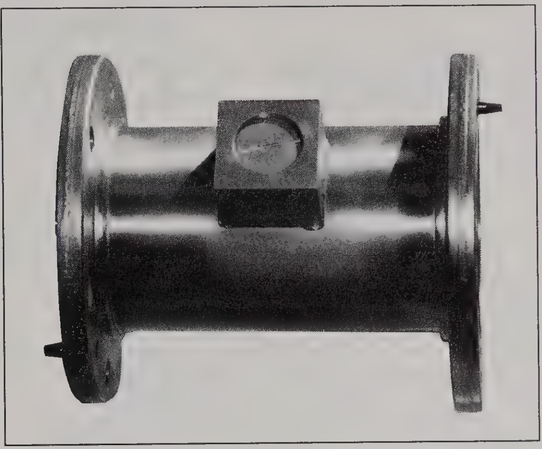
Order: Impulse Suppressor-Power kW, connector

IS-10KWLC	for LC connectors females only
IS-10KW78E	for 7/8" EIA connectors

HIGH POWER MILITARY AND BROADCAST COAXIAL PROTECTOR

APPLICATION:

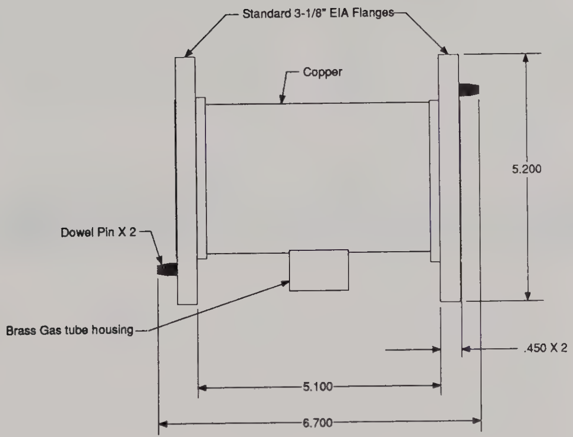
High powered HF, VHF to low UHF Military and FM/TV Broadcast.



Model shown 3-1/8" EIA

- ☐ EMP and lightning
- ☐ EIA flanges 1-5/8" and 3-1/8"
- ☐ Dc to 700MHz typical bandwidths
- ☐ VSWR and IL plots from HP 8753C
- ☐ Custom 1kW to 80kW power rating
- ☐ Fast <25 ns turn-on time
- ☐ Unique PolyPhaser® gas tube design for fast response and fast restoration
- ☐ Field replaceable gas tube
- ☐ Air tight "through" for dry air or N pressure
- ☐ SS hardware and gasket

OPTIONS AVAILABLE:
Center bullets are available for either EIA size, Extra gas tubes, Scope plot of turn-on voltage



MAXIMUM CHARACTERISTICS

Surge:
100kA ANSI C62.1 8/20 waveform 1000 Joules

Turn-on:
custom from 800V to 12kV

Turn-on Time:
<25ns for 2kV/ns

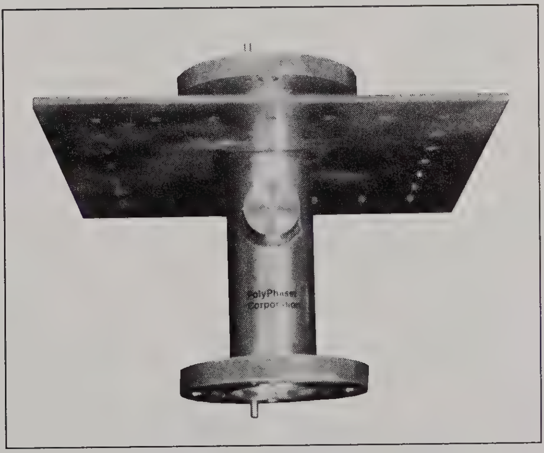
Frequency Range:
dc to 700MHz (may vary with requirements)

VSWR:
≤1.1 to 1 typically 1.03 to 1 (FM broadcast)

Insertion Loss:
≤0.1dB typically 0.03dB (FM broadcast)

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



Model shown 20kW NATO unit for screen room

Order: Call with requirements

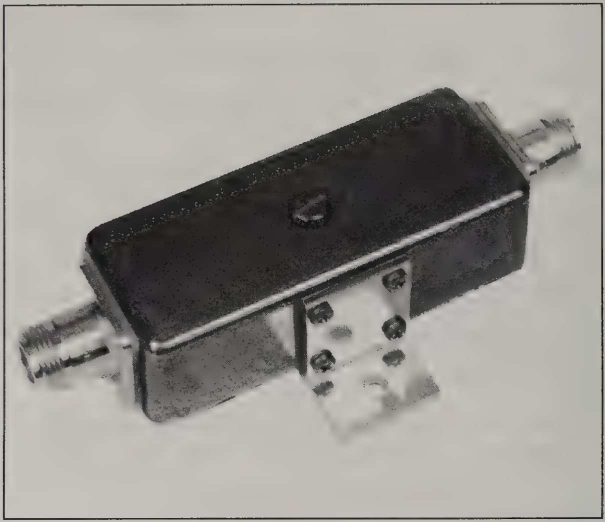
PART 2 dc type with isolated shield dc-200MHz

50/75/93 OHM ISOLATED EARTH BASEBAND COAXIAL PROTECTORS - FLANGE MOUNT

APPLICATION:

LAN and Video where single grounds are needed to prevent ground loops/hum.

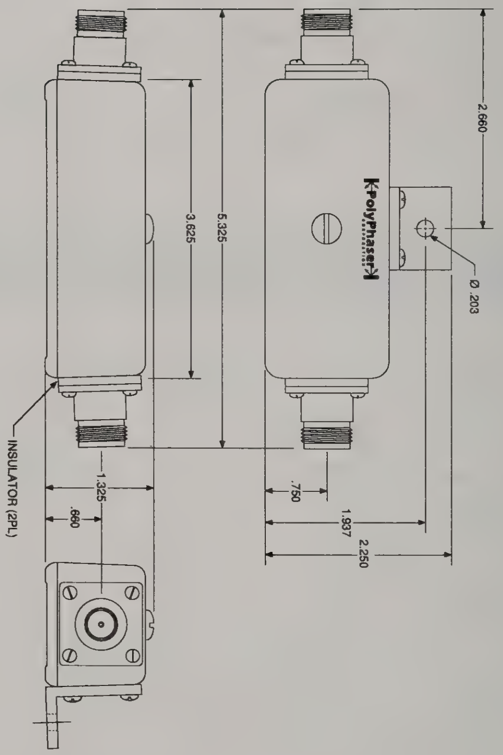
- ☐ Provides coax shield to ground isolation of 90V
- ☐ Helps prevent ground loops
- ☐ Bi-directional signals/protection
- ☐ Broadband-low VSWR and loss
- ☐ Multi-strike capability
- ☐ Low voltage threshold
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware



Model shown IS-IE50NB

OPTIONS AVAILABLE: 1.5, 18, 26, 32 volt thresholds all models, Watertight, 50 and 75 ohms models only, Bulkhead version available, Higher Frequencies to 200MHz for 50 ohm

MIL SPECS: Mil-STD-202 107F Cond.B -65°C to 125°C, Op to 70,000'; N Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365; Solder QQ-S-571 Sn62, follows Mil-STD-454J



MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Frequency Range:
dc to 30MHz 50 ohm models
dc to 15MHz 75 ohm models
dc to 20MHz 93 ohm models

Turn-on:
±7Vdc ±20%

Turn-on Time:
4ns for 2kV/ns

Impedance:	Model:	Connectors
50 ohms	IS-IE50	BNC, UHF, N
75 ohms	IS-IE75	BNC, F
93 ohms	IS-IE93	BNC

VSWR:
<1.1 to 1 over frequency range

Insertion Loss:
≤0.3dB over frequency range

Throughput Energy:
≤16μJ for 1kV/ns waveform

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

Order: IS-Isolated Earth, ohms, connector, Baseband

IS-IE50BB	50Ω BNC females
IS-IE50NB	50Ω N females
IS-IE50UB	50Ω UHF females
IS-IE75BB	75Ω BNC(50Ω) females
IS-IE75FB	75Ω F females
IS-IE93BB	93Ω BNC(50Ω) females

Add suffix to any model: **-MA** for a male connector
Add $5.00 for each N or BNC male
Add $10.00 for each UHF male

LOCAL AM RADIO LOOPS/TRANSMITTERS - FLANGE MOUNT

APPLICATION:

Low powered AM local informational broadcast.

ANTENNA
IS-50UB-C
PolyPhaser Corporation
Made in USA
EQUIPMENT
U.S. Patents 4,359,764, 4,409,637 & 4,554,608
Other U.S. & Foreign Patents Pending

Model shown IS-50UB-C

- ☐ Handles up to 40Wpep
- ☐ Dc blocked for lower strike throughput energy
- ☐ Works on all equipment-unlike dc continuity protectors which can't protect receivers, shunt fed cavities, etc.
- ☐ Multi-strike capability
- ☐ Low VSWR and loss
- ☐ UHF female connectors standard
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ UHF connectors-silver center, TFE

OPTIONS AVAILABLE:
Watertight units available with type N connectors only, bulkhead mount

MIL SPECS:
Mil-STD-202 107F Cond.B -65°C to 125°C, Op to 70,000'; Connectors Mil-C-39012, QQ-C-530, and QQ-S-365

MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Turn-on:
90 Vdc ±20%

Turn-on Time:
4ns for 2kV/ns

Throughput Energy:
3mJ

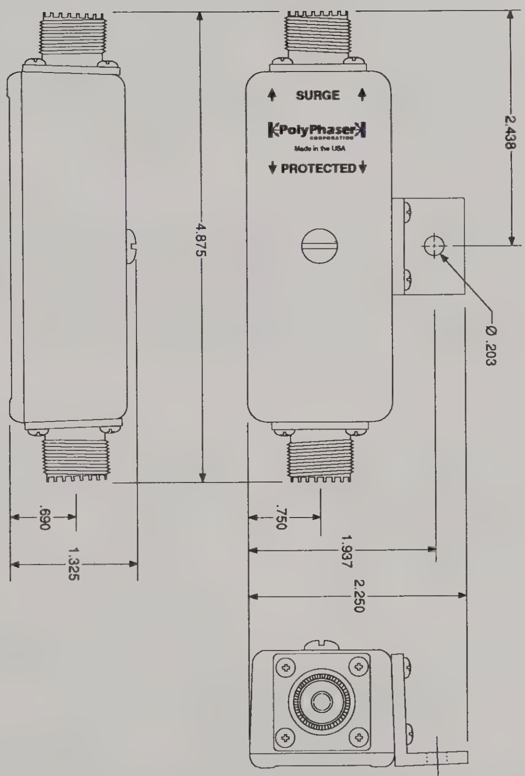
VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Frequency Range:
450kHz to 2MHz

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



Order: Impulse Suppressor-ohms, connector, base, -frequency

IS-50UB-C 50Ω UHF females

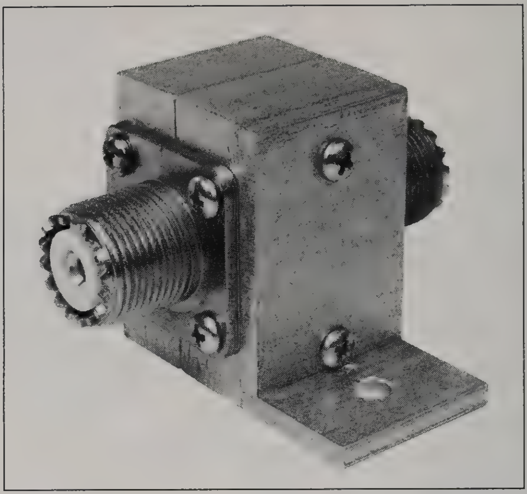
Add suffix to any model: **-MA** for a male connector
Add $10.00 for each UHF male

PART 3 dc blocked 1.5-1000MHz

BROADBAND HF/VHF/UHF COAXIAL PROTECTORS - FLANGE MOUNT

APPLICATION:

General radio use where transmitter combining is not done - surface mounting.



Model shown IS-50UX-C1

- ☐ 50 and 75 ohm models
- ☐ Works on all equipment unlike dc continuity which can't protect receivers, shunt fed cavities, etc.
- ☐ Multi-strike capability
- ☐ Low strike throughput energy
- ☐ Flange ground/mount
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ UHF connectors silver center, TFE
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Diver tested watertight 50Ω models available in N connectors only; BNC (both sex), TNC and SMA (females only) connectors, other 75Ω models with 75Ω N connectors available, VSWR and IL plots

MIL SPECS: Meets 6' all angle drop test, Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Watertight option meets many Mil specs under 202 and 810 for vibration, shock (both), fungus, etc. UHF&N Connectors Mil-C-39012, QQ-S-365, QQ-B-626, QQ-C-530, QQ-S-365 and Mil-G-45204, follows Mil-STD-454J, Solder QQ-S-571 Sn62

MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

Turn-on:
600 Vdc ±20%

Turn-on Time:
2.5ns for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range (50Ω)
≤1.2 to 1 over frequency range (75Ω)

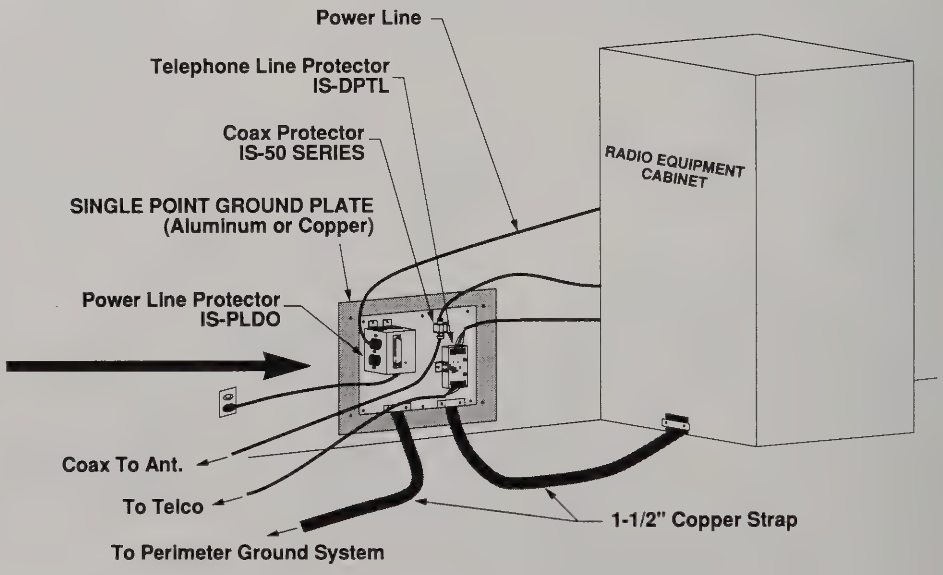
Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764,
4,409,637, 4,554,608
Canadian Patent # 1,185,314
and other U.S. and Foreign
Patents Pending.

NEW SINGLE POINT GROUND PLATE FOR PROPER GROUNDING/PROTECTION

(See page 50)



BROADBAND HF/VHF/UHF COAXIAL PROTECTORS - FLANGE MOUNT

Order: Impulse Suppressor-ohms, connector, "X", -Capacitor, frequency #

UHF CONNECTORS (Females Standard)

IS-50UX-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-50UX-C1 ≤600µJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

F CONNECTORS (Females Standard)

IS-75F-C1 ≤1mJ Throughput Energy
Frequency Range: 4MHz to 900MHz (1.2 to 1 VSWR)
Max. Power: HF 100W, VHF 100W, UHF 25W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on the antenna port
-ME for male on the equipment port

Add $10.00 for each UHF male
Add $5.00 for each F male

N CONNECTORS (Females Standard)

IS-50NX-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

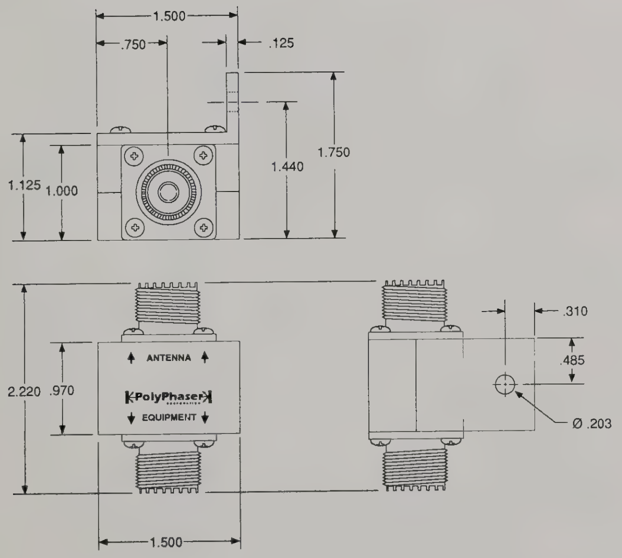
IS-50NX-C1 ≤600µJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

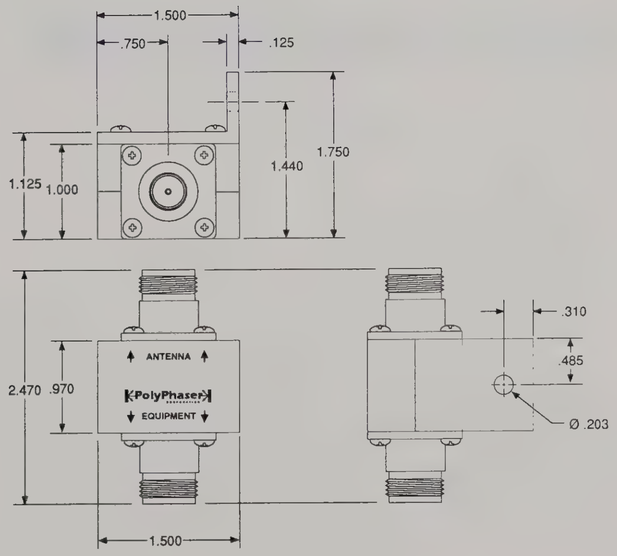
IS-50NX-C2 ≤220µJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 375W, UHF (low) 125W
800MHz to 1GHz 50W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on the antenna port
-ME for male on the equipment port

Add $5.00 for each N male



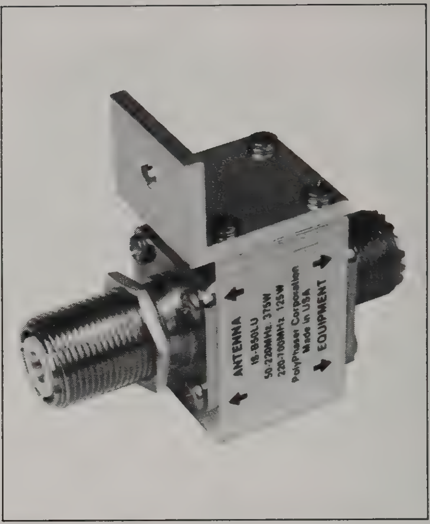


PART 3 dc blocked 1.5-1000MHz

BROADBAND HF/VHF/UHF COAXIAL PROTECTORS - BULKHEAD MOUNT

APPLICATION:

General radio use where transmitter combining is not done - bulkhead mount for screen room/shielded room penetration.



Model shown IS-B50LU-C1
available in N and UHF connectors

- ☐ 50 ohm models
- ☐ 1.5MHz to 1000MHz (over three models)
- ☐ Works on all equipment unlike dc continuity protectors which can't protect receivers, shunt fed cavities, etc.
- ☐ Multi-strike capability
- ☐ Low strike throughput energy
- ☐ Bulkhead mounting/grounding to 1/4" thickness
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ UHF nickel shell, silver center, TFE
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, Bracket for surface mounting, Diver tested watertight model for "L" units only, EMI/RFI weather washer, VSWR and IL plots

MIL SPECS: Meets 6' all angle drop test, Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Watertight option meets many Mil specs for 202 and 810 for shock (both), vibration, fungus, etc. Connectors Mil-C-39012, QQ-S-365, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J

MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

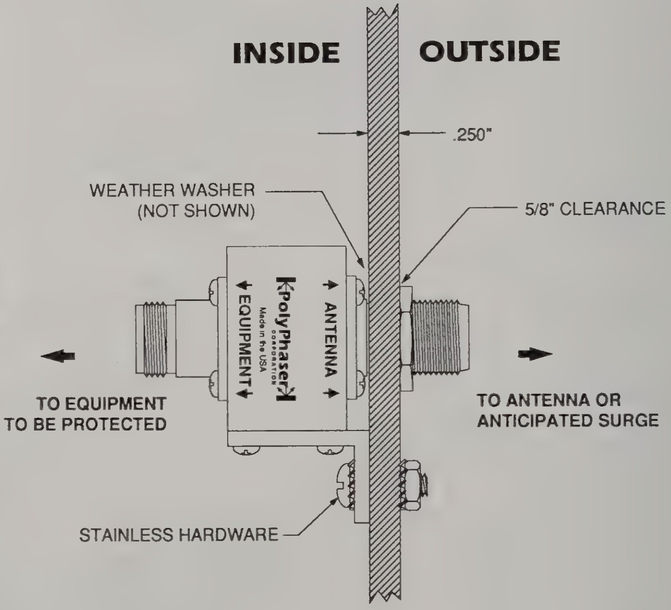
Turn-on:
600 Vdc ±20% L models
1200Vdc ±20% H models

Turn-on Time:
2.5ns L; 7ns H; for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C


INSIDE
OUTSIDE
.250"
WEATHER WASHER (NOT SHOWN)
5/8" CLEARANCE
ANTENNA
PolyPhaser CORPORATION Made in the USA
EQUIPMENT
TO EQUIPMENT TO BE PROTECTED
TO ANTENNA OR ANTICIPATED SURGE
STAINLESS HARDWARE

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

BROADBAND HF/VHF/UHF COAXIAL PROTECTORS - BULKHEAD MOUNT

Order: Impulse Suppressor-Bulkhead, ohms, power, connector, -Capacitor, frequency #

UHF CONNECTORS (Females Standard)

IS- B50LU-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-B50HU-C0 ≤20mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 3kW, VHF 500W, UHF 250W

IS-B50LU-C1 ≤600μJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

IS-B50HU-C1 ≤1mJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 500W, UHF 250W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)
-ME for male on equipment port

Add $10.00 for each UHF male

N CONNECTORS (Females Standard)

IS-B50LN-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-B50HN-C0 ≤20mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 3kW, VHF 500W, UHF 250W

IS-B50LN-C1 ≤600μJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

IS-B50HN-C1 ≤1mJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 500W, UHF 250W

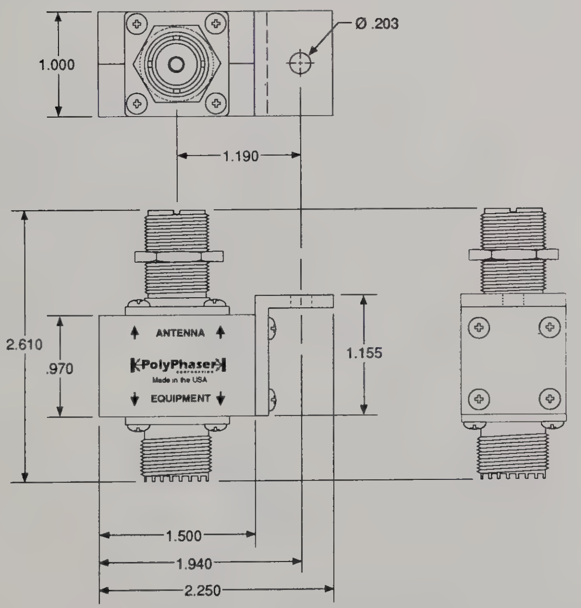
IS-B50LN-C2 ≤220μJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 375W, UHF (low) 125W
800MHz to 1GHz 50W

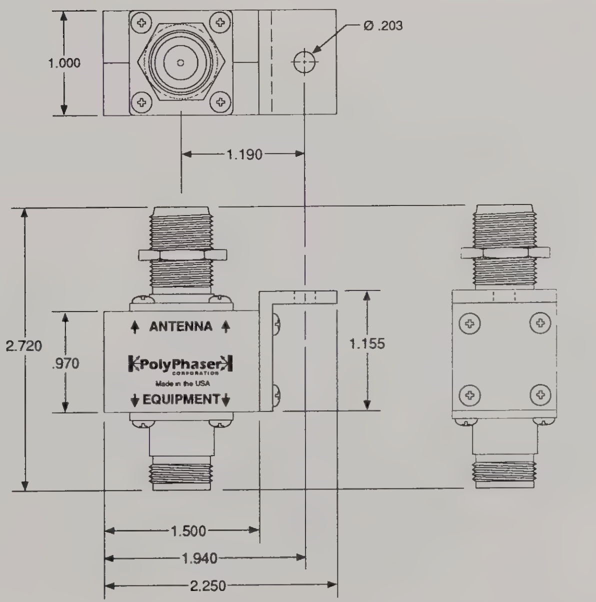
IS-B50HN-C2 ≤800μJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 500W, UHF (low) 250W
800MHz to 1GHz 125W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)
-ME for male on equipment port

Add $5.00 for each N male



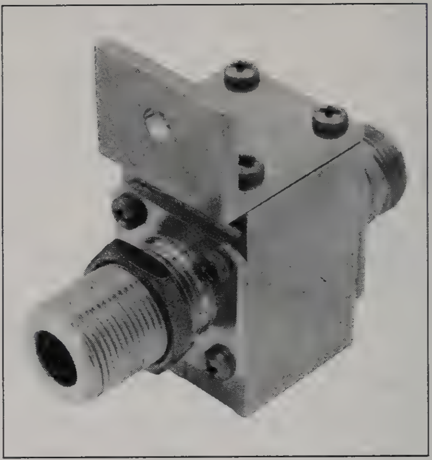


PART 3 dc blocked 1.5-1000MHz

NUCLEAR EMP COAXIAL PROTECTOR

APPLICATION:

Military, government (FEMA and NCA), protection of emergency radio communications equipment.



Model shown IS-NEMP-C0

- ❑ Patented technology
- ❑ Low throughput energy
- ❑ Aluminum enclosure
- ❑ Ultra-fast response
- ❑ High surge current handling
- ❑ 18-8 SS hardware
- ❑ Bulkhead mountable up to 1/4" thick panels
- ❑ Silver with Gold connectors for low intermod generation
- ❑ Highest pulse attenuation (30.14dB-for IS-NEMP (-CO) of all models tested by NCS (TIB 85-10 document)
- ❑ Works for both Lightning and NEMP events unlike dc continuity protectors which can't protect receivers and shunt fed cavities from lightning due to their own dc path
- ❑ Mounts outside screen room penetration panel or equipment housing for best skin effect and pulse attenuation
- ❑ EMI/RFI weather washer for low impedance no drip penetration

OPTIONS AVAILABLE: Other connector types and sex: BNC, TNC, SMA, UHF available, only the UHF (female) are threaded, Crossing connectors types to make unit an adaptor, Diver tested watertight version available, VSWR and IL plots

MIL SPECS: Meets 6' all angle drop test, Op to 70,000'; Mil-STD-202, 107F, cond G. -65°C to 125°C, Watertight option meets many Mil spec for 202 and 810 for shock (both), vibration, fungus etc. Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J (For Mil-STD-462 testing see page 56)

MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

Turn-on:
330Vdc ±20%

Turn-on Time:
1.5ns for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C

Order: Impulse Suppressor-NuclearEMP-Capacitor, freq.#

N CONNECTORS (Females Standard)

IS-NEMP-C0 ≤314µJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 500W, VHF 200W, UHF 100W

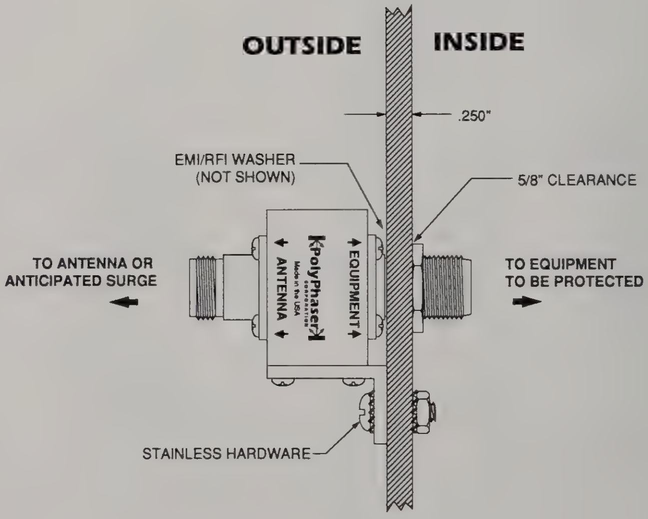
IS-NEMP-C1 ≤570µJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 200W, UHF 100W

IS-NEMP-C2 ≤270µJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 200W, UHF (low) 100W
800MHz to 1GHz 50W

Choose lowest throughput energy for desired frequency
Energy measured with 2kV/ns waveform

Add suffix: **-MA** for male connector on antenna port
-ME for male on equipment port
(not threaded like female shown)

Add $5.00 for each N male connector



U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

MICROWAVE COAXIAL PROTECTORS - BULKHEAD MOUNT

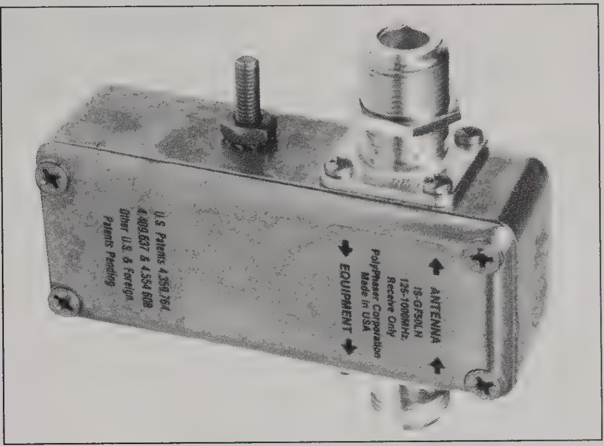
APPLICATION:

Lightning/NEMP protection for any frequency range from 1GHz to 6GHz for point to point links transmit/receive and broadcast to 100W.

- ☐ 50 ohm models (4 stocked, others custom)
- ☐ 1GHz to 20GHz with 250 to 1000MHz bandwidths
- ☐ Works on all equipment unlike dc continuity protectors which can't protect receivers, shunt fed cavities, etc.
  (for dc power via coax line see pages 20 & 21)
- ☐ Multi-strike capability
- ☐ Low strike throughput energy
- ☐ Bulkhead mounting/grounding to 1/4" thickness
- ☐ Housed use only
- ☐ 18-8 SS hardware
- ☐ N silver shell and gold center for low intermod generation
- ☐ Female type N connectors only for 2.6GHz and up models

OPTIONS AVAILABLE: Return Loss or VSWR and Insertion Loss plots, Extra connector nut, Bracket for surface mounting, EMI/RFI weather washer, VSWR and IL plots

MIL SPECS: Op to 70,000", Mil-STD-202, 107F, Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-Std-454J


ANTENNA
PolyPhaser Corporation
Made in USA
EQUIPMENT
U.S. Patents 4,359,764, 4,409,637 & 4,554,608
Other U.S. & Foreign Patents Pending

Model shown is similar to the IS-ML50LN

MAXIMUM CHARACTERISTICS

Surge:
20kA ANSI C62.1 8/20 waveform

Turn-on:
600Vdc ±20%

Turn-on Time:
2.5ns for 2kV/ns

VSWR:
≤1.2 to 1

Power:
100W

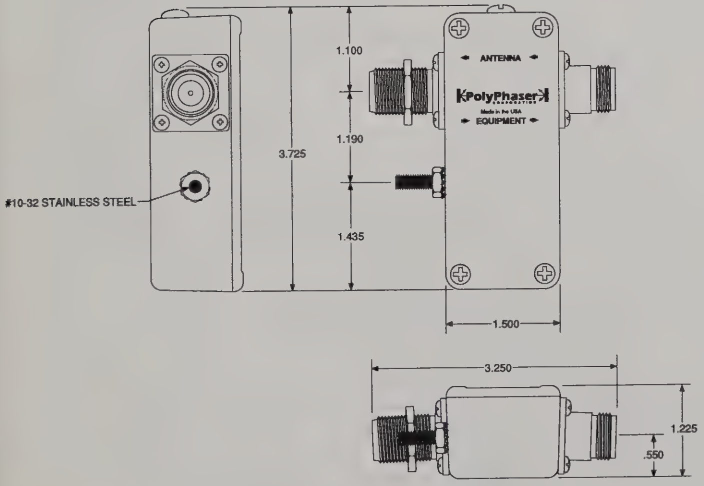
Insertion Loss:
≤0.1dB

Throughput Energy:
≤1µJ for 2kV/ns

NEMP Peak Throughput Voltage:
35Vp for 5kV/5ns

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



Order: Impulse Suppressor-name, ohms, Low pwr, N connectors

IS-MR50LN	for 1.2GHz to 1.4GHz Microwave Radio (Ham)
IS-ML50LN	for 1.7GHz to 2.0GHz Microwave Low 2GHz
IS-MH50LN	for 2.0GHz to 2.3GHz Microwave Hi 2GHz
IS-MT50LN	for 2.1GHz to 2.6GHz Microwave TV for MMDS

Add suffix to above models: **-MA** for male N on antenna port (not threaded like female shown)
-ME for male N on equipment port

Add $5.00 for each N male

PART 4 dc blocked and grounded 20-1000MHz

FILTERED AND GROUNDED COAXIAL PROTECTORS - BULKHEAD MOUNT

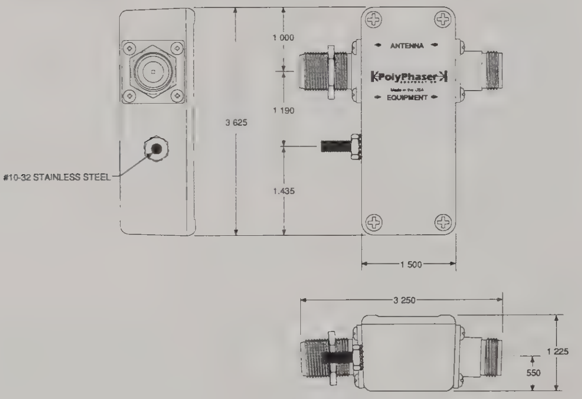
APPLICATION:

GaAs FET receivers and low powered transmitters from 20MHz to 1GHz.

- ☐ Four Pole filter further attenuates strike energy
- ☐ >21dB (LR), >107dB (GF) attenuation of lightning frequencies (0.3 MHz)
- ☐ Ultra-Low throughput energy
- ☐ Dc grounded on equipment port for less strike noise
- ☐ Wide Bandwidths
- ☐ Multi-strike capability
- ☐ Bulkhead mounting/grounding to 1/4" thickness
- ☐ Housed use only
- ☐ Aluminum enclosure, 18-8 SS hardware
- ☐ UHF nickel shell, silver center, TFE
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, Bracket for surface mounting, EMI/RFI washer, Lower frequency units available, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F Cond.B - 65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J



Order: Impulse Suppressor-name, ohms, Low pwr, connector
LR = Low band Radio GF = GaAs FET

UHF CONNECTORS (Females Standard)

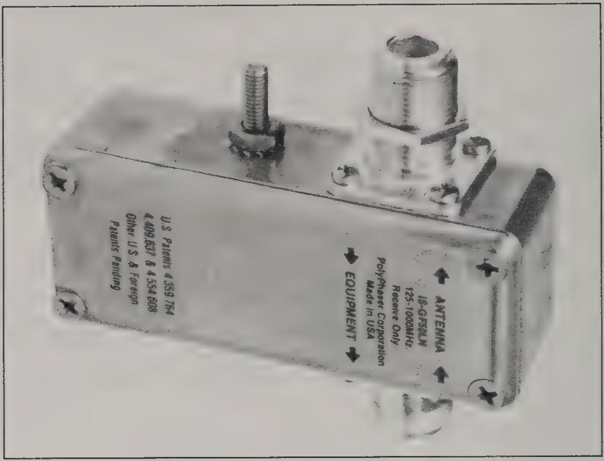
IS-LR50LU ≤ 700μJ Throughput Energy
Frequency Range: 20MHz to 250MHz
Max. Power: HF 25W, VHF 10W

IS-GF50LU ≤ 150pJ Throughput Energy
Frequency Range: 50MHz to 550MHz
Max. Power: VHF 10W, UHF 5W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)
-ME for male on equipment port

Add $10.00 for each UHF male



Model shown IS-GF50LN available in N and UHF connectors

MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Turn-on:
90V ±20%

Turn-on Time:
4ns for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

N CONNECTORS (Females Standard)

IS-LR50LN ≤ 700μJ Throughput Energy
Frequency Range: 20MHz to 300MHz
Max. Power: HF 25W, VHF 10W

IS-GF50LN ≤ 150pJ Throughput Energy
Frequency Range: 80MHz to 900MHz
(50MHz to 1GHz ≤1.2 to 1 VSWR)
Max. Power: VHF 10W, UHF 5W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

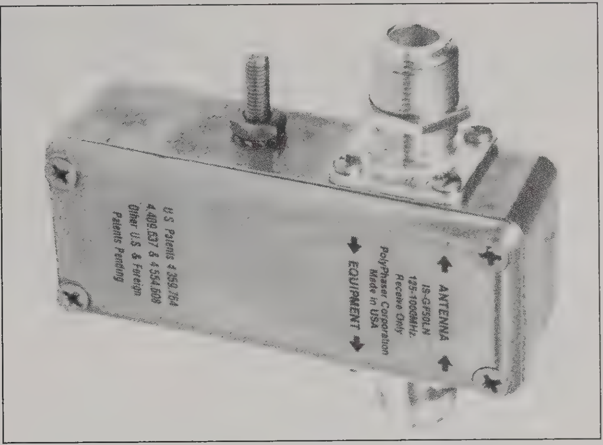
Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)
-ME for male on equipment port

Add $5.00 for each N male

DC PATH-MW DOWNCONVERTED COAXIAL PROTECTORS - BULKHEAD MOUNT

APPLICATION:

18GHz and up Microwave Systems that use Gunnplexers and have 50-500MHz IF frequencies with power and/or data or error signals in the dc to 0.5MHz band. Two are required for complete protection - one inside the tower top unit and one inside the hut at the bulkhead panel.



Model shown is similar to IS-MD50LNZ

- ☐ **Transceive Bi-directional to signals**
- ☐ **Handles and protects standard telco battery power on coax**
- ☐ **Patented design separates the dc from the RF, protects each optimally and recombines them**
- ☐ **Bulkhead mounting/grounding to 1/4" thickness**
- ☐ **Lower throughput energy than dc continuity protectors** (dc type protectors with a gas tube will not handle the voltage and current for this application without the tube staying on and destroying itself with the first strike)
- ☐ **Multi-strike capability**
- ☐ **Aluminum enclosure**
- ☐ **18-8 SS hardware**
- ☐ **N silver shell and gold center for low intermod generation**
- ☐ **NEMP rated**
- ☐ **Housed use only**

OPTIONS AVAILABLE: Extra connector nut, Bracket for surface mounting, EMI/RFI weather gasket, Other voltages available below 60Vdc and ac, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J

MAXIMUM CHARACTERISTICS

Surge:
20kA ANSI C62.1 8/20 waveform 138 Joules

Turn-on:
-66Vdc, 2Vdc ±10%

Turn-on Time:
4ns for 2kV/ns

VSWR:
≤1.2 to 1 over frequency range

Insertion Loss:
≤0.3dB

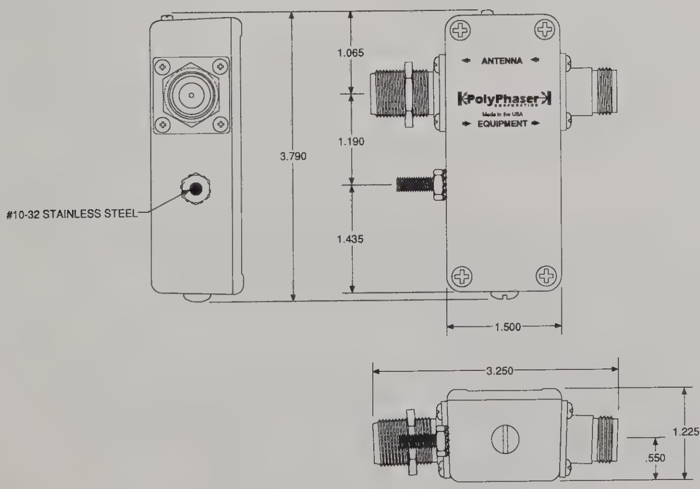
Throughput Energy:
10μJ for 1kV/ns

Usage Current:
1Adc continuous

Frequency Range:
dc to 0.5MHz and 50MHz to 500MHz

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



Order: IS-Microwave Dwnconverter, ohms, Low pwr,
conn, Z = dc path

IS-MD50LNZ (N connectors only)

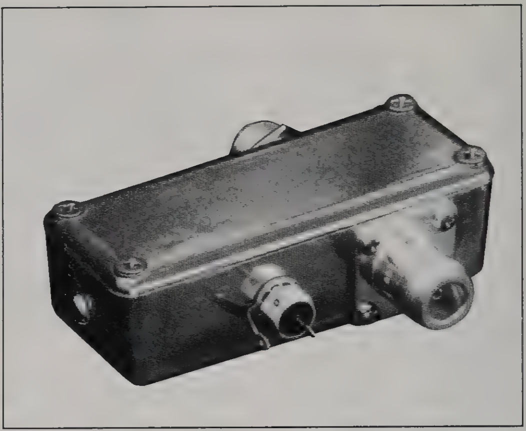
Add suffix: **-MA** for male N on antenna port (not threaded like female shown)
-ME for male equipment port

Add $5.00 for each N male

DC INJECTOR/PICKOFF/PICKOR COAXIAL PROTECTORS - BULKHEAD MOUNT

APPLICATION:

To supply or control remote equipment by injecting an ac or dc voltage onto the coax line and picking it off. A "pickor" is a contraction of pickoff and injector. It is transparent to supply voltages. It protects optimally by separating the supply voltage and the RF, protecting each, then re-injecting the supply voltage onto the coax. Ideal for bulkhead locations to prevent the surge from getting into the facility.



Model shown IS-DC50LN

- ☐ Multi-stage patented design
- ☐ Multi-strike capability
- ☐ Low throughput energy
- ☐ >94dB attenuation of lightning frequencies (0.3MHz)
- ☐ Receive only (Transmit units available)
- ☐ Bulkhead mounting/grounding 1/4" thickness
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, other voltages +20, +26, +30, +36 and -60Vdc, Ac voltages, Higher user currents, Other frequencies range from 1.5MHz to 20GHz, Transmit and combiner capabilities to 1kW at some frequency ranges, Other impedances/connectors, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J

MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Turn-on:
17Vdc, -1Vdc ±5%

Turn-on Time:
<4ns for 2kV/ns

Let Through dc Port:
+26Vp, -23Vp open circuit- ±10kA 8/20

Frequency Range:
400MHz to 960MHz

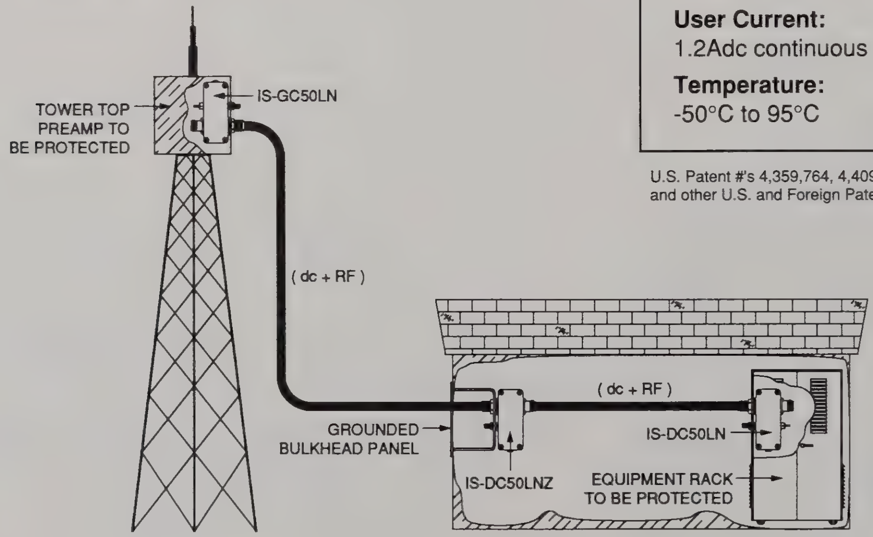
VSWR:
≤1.2 to 1 over the frequency range

Insertion Loss:
≤0.3dB over the frequency range

User Current:
1.2Adc continuous

Temperature:
-50°C to 95°C

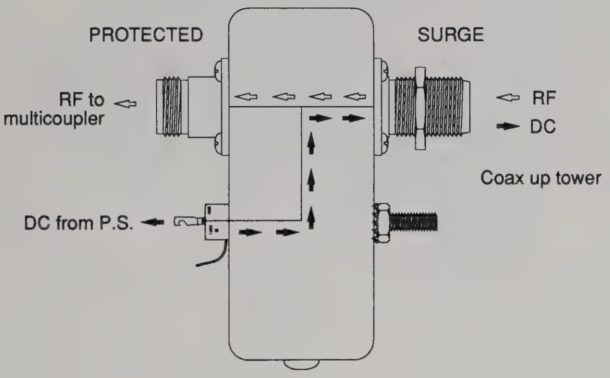
U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



TYPICAL APPLICATION

DC INJECTOR/PICKOFF/PICKOR COAXIAL PROTECTORS - BULKHEAD MOUNT

DC INJECTOR



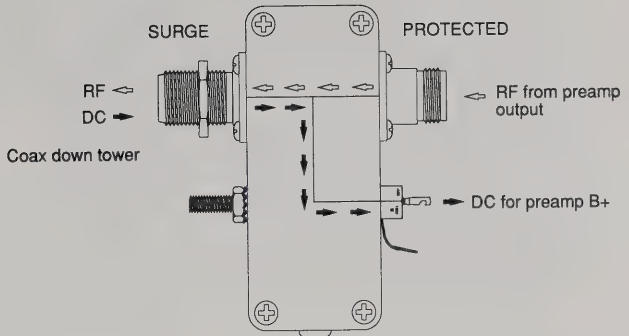
INJECTS DC ONTO THE COAX

Order: **IS-DC50LN** Injector (N females standard)

Add suffix: **-MA** for male connector bulkhead port (not threaded like female shown)
-ME for male opposite bulkhead port

Add $5.00 for each N male

DC PICKOFF



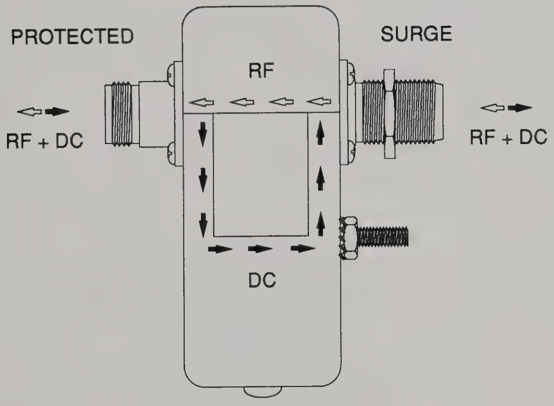
PICK OFF DC BUT OPTIMIZED FOR OPPOSITE RF PASSAGE

Order: **IS-GC50LN** Pickoff (N females standard)

Add suffix: **-MA** for male connector bulkhead port (not threaded like female shown)
-ME for male opposite bulkhead port

Add $5.00 for each N male

DC PICKOR

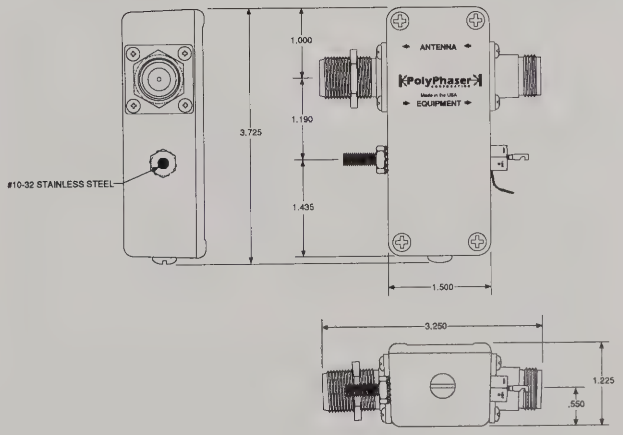


PICK OFF DC AND RE-INJECTS FOR OPTIMAL PROTECTION FOR BULKHEAD PANEL USERS

Order: **IS-DC50LNZ** Pickor (N females standard)

Add suffix: **-MA** for male connector bulkhead port (not threaded like female shown)
-ME for male opposite bulkhead port

Add $5.00 for each N male



PART 5 dc injector/dc path 450-1450MHz

BROADBAND DC PATH 75 OHM COAXIAL PROTECTOR

APPLICATION:
Satellite dish receivers where the LNB(s) is powered via the coax line from the receiver. Simplex RF LAN operation with switched antenna preamp.

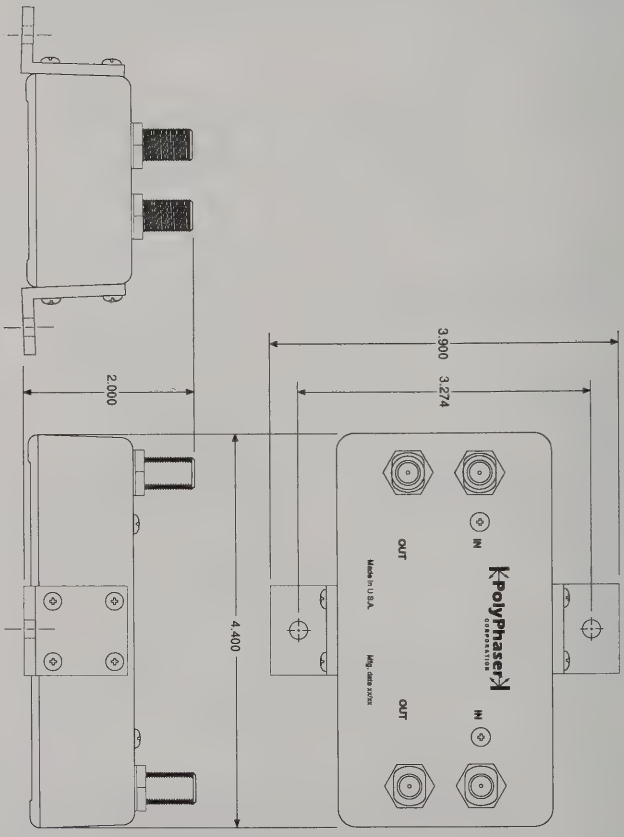
IS-DB75F
PolyPhaser
CORPORATION
IN
IN
OUT
OUT
U.S. Patents 4,359,764, 4,409,637 & 4,554,608 Other U.S. & Foreign Patents Pending
Made in U.S.A.
01/92

Model shown IS-DB75F

- ☐ Single and Dual LNB models
- ☐ Two-stage Patented design
- ☐ Multi-strike capability
- ☐ Housed use only - Mounts into IS-TVRO (see pages 28 and 29)
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware

OPTIONS AVAILABLE:
Other dc voltages 6V, 17V, 30V available, 75 ohm type N female connectors available

MIL SPECS:
Op to 70,000', Mil-STD-202 107F Cond.B -65°C to 125°C, Solder QQ-S-571 Sn62, follows Mil-STD-454J



MAXIMUM CHARACTERISTICS

Surge:
18kA ANSI C62.1 8/20 waveform 110 Joules

Turn-on:
26Vdc, -1Vdc ±5%

Turn-on Time:
6ns for 2kV/ns

VSWR:
1.2 to 1 over the frequency range

Insertion Loss:
≤0.3dB over the frequency range

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

Order: Impulse Suppressor-Single lnB, ohms, connector

IS-SB75F	for single protector (F females standard)
IS-DB75F	for dual protector (F females standard)

VHF/UHF CROSS BAND COMBINER COAXIAL PROTECTORS - BULKHEAD MOUNT

APPLICATION:

Where multi-band transmit channels are combined to save transmission line expense and then re-separated for individual band antennas.

- ☐ High number of combined channels handled
- ☐ High turn-on for clean peak voltage handling
- ☐ High channel power handling
- ☐ Dc blocked design
- ☐ Low throughput energy
- ☐ Multi-strike capability
- ☐ Bulkhead mounting/grounding to 1/4" thickness
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, Bracket for surface mounting, Diver tested watertight model for VU only, EMI/RFI weather washer, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F, Cond.B -65°C to 125°C, Watertight option meets many Mil specs for 202 and 810 for shock (both), vibration, fungus etc. Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J

Order: Impulse Suppressor-band names, ohms, High pwr, connector

V=150MHz band, U=450MHz band, C=800/900MHz

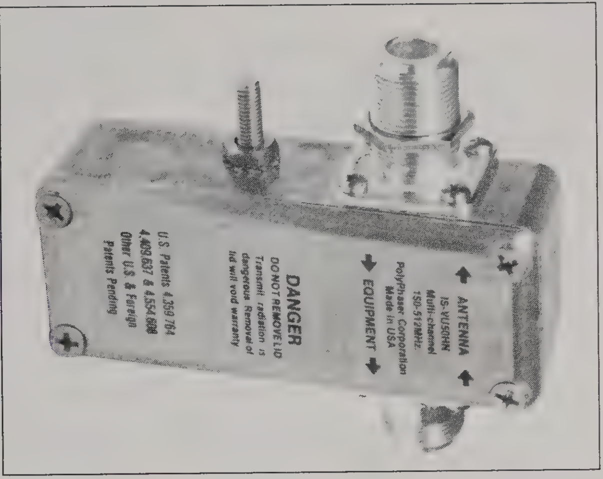
IS-VU50HN ≤7mJ throughput energy
Frequency Range: 50MHz to 550MHz
Max. Power: 750W single channel
See formula for multi-channel page 56

IS-CU50HN ≤5mJ throughput energy
Frequency Range: 450MHz to 900MHz
Max. Power: 750W single channel
See formula for multi-channel page 56

N female connectors standard both models

Add suffix: **-MA** for male on antenna port
-ME for male on equipment port

Add $5.00 for each N male



Model shown IS-VU50HN

MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

Turn-on:

1800Vdc	Vt= 1200V	IS-VU50HN
1200Vdc	Vt= 1200V	IS-CU50HN

Turn-on Time:

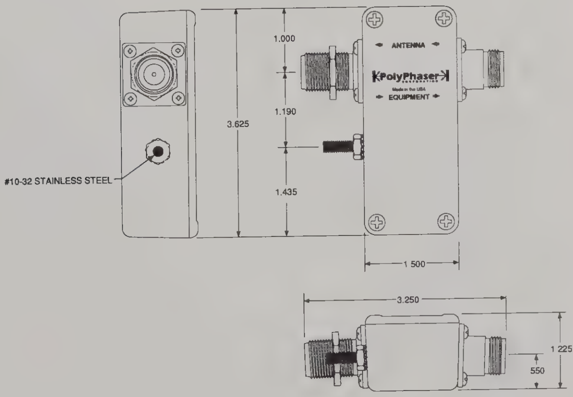
15ns	IS-VU50HN
7ns	IS-CU50HN

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C

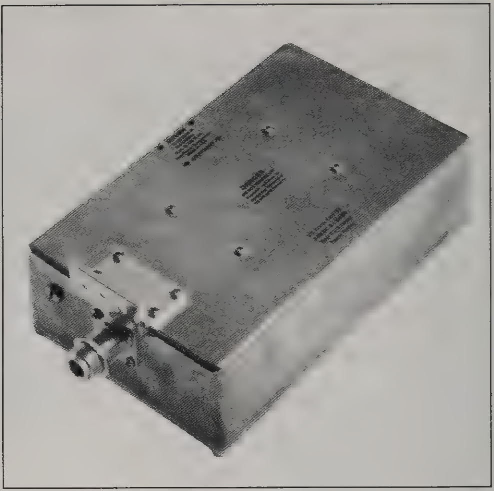
U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



UHF COMBINER COAXIAL PROTECTOR - BULKHEAD OR FLANGE MOUNT

APPLICATION:

For the UHF 450MHz to 512MHz band where multi-transmitters are combined,excellent receive only protector.



Model shown IS-UT50HN-B

- ❑ Multi-strike capability
- ❑ Unique dc blocked air strip line design
- ❑ >75dB attenuation of lightning frequencies (0.3MHz)
- ❑ Very low throughput energy
- ❑ High number and power of combined channels handled (see page 56 for formula) 750W single channel
- ❑ Works on all equipment unlike dc continuity protectors which can't protect receivers and shunt fed cavities, etc.
- ❑ Housed use only
- ❑ Aluminum enclosure
- ❑ 18-8 SS hardware
- ❑ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, UHF connectors, Other frequencies range 400-450MHz, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J

MAXIMUM CHARACTERISTICS

Surge:
20kA ANSI C62.1 8/20 waveform 130 Joules

Turn-on:
1200 Vdc Vt= 1200V

Turn-on Time:
7ns for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

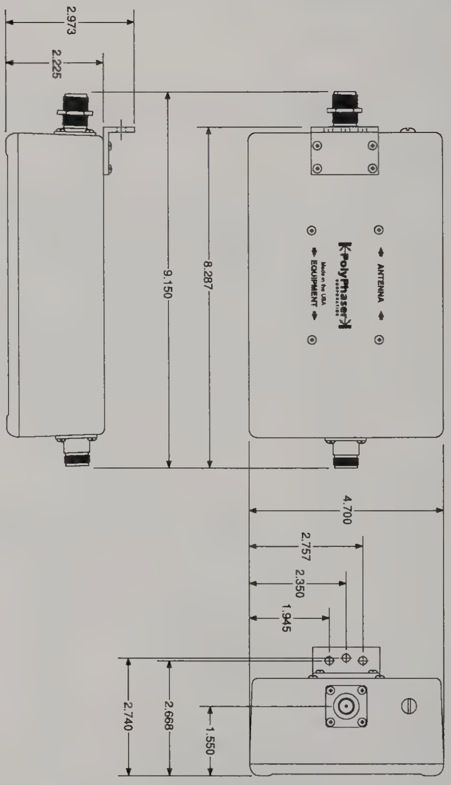
Insertion Loss:
≤0.1dB over frequency range

Throughput Energy:
10μJ for 8/20 waveform

Temperature:
-50°C to 125°C

Max. Power:
750W single channel.
See formula for multi-channel page 56

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.



Order: IS-UHF, Transmit, ohms, High pwr, N connector (-bulkhead)

IS-UT50HN for flange mount
IS-UT50HN-B for bulkhead mount

Add suffix: **-MA** for male connector antenna port (not threaded like female shown)
-ME for male equipment port

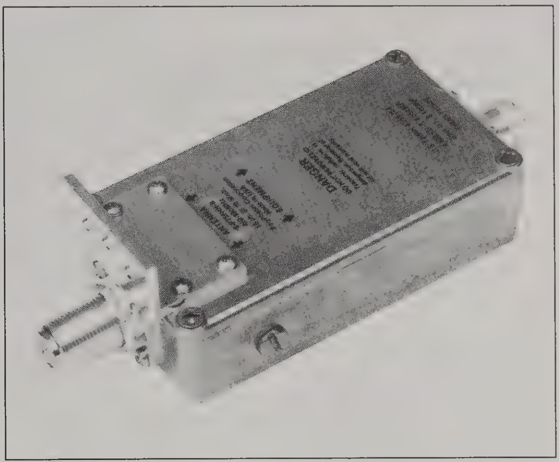
Add $5.00 for each N male

UHF COMBINER COAXIAL PROTECTOR - BULKHEAD OR FLANGE MOUNT

APPLICATION:

For the 800-980MHz bands where multi-transmitters are combined, excellent receive only protector, Broadcast STL links.

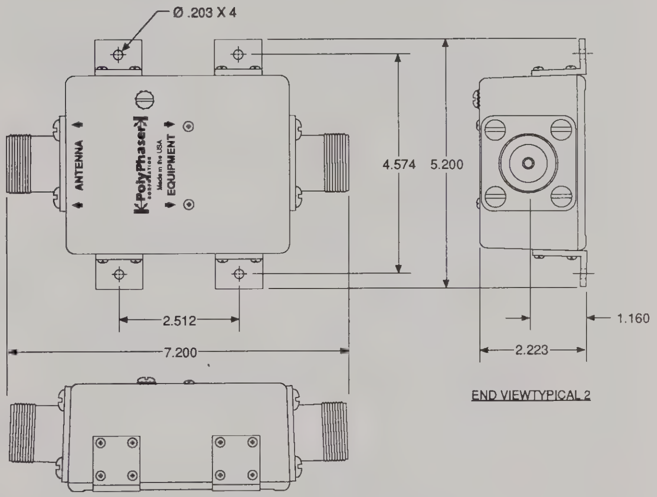
- ☐ Multi-strike capability
- ☐ Unique dc blocked air strip line design
- ☐ >77dB attenuation of lightning frequencies (0.3MHz)
- ☐ Very low throughput energy
- ☐ High number and power of combined channels handled (see page 56 for formula) 750W single channel
- ☐ Works on all equipment unlike dc continuity protectors which can't protect receivers and shunt fed cavities, etc.
- ☐ Bulkhead mounting/grounding to 1/4" panels for type N connectors
- ☐ Housed use only - aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ N silver shell and gold center for low intermod generation
- ☐ LC silver shell with silver center



Model shown IS-PT50HN-B

OPTIONS AVAILABLE: Extra N connector nut, Dc injection/pickoff/pickor see page 20, 7/8" center bullets, LC in bulkhead, VSWR and IL plots, 7/16 D/N

MIL SPECS: Meets 6' all angle drop test, Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J



Model shown IS-CT50HLC

MAXIMUM CHARACTERISTICS

Surge:
20kA ANSI C62.1 8/20 waveform 138 Joules

Turn-on:
1200Vdc Vt= 1800V

Turn-on Time:
2.5ns for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Throughput Energy:
10µJ for 8/20 waveform

Temperature:
-50°C to 125°C

Max. Power:
750W single channel
See formula for multi-channel page 56

Order: IS-Cell/Page Transmit, ohms, High pwr, connector

IS-CT50HN
for 800-900MHz, type N females, flange mount

IS-CT50HN-B
for 800-900MHz, type N females, -Bulkhead mount

IS-CT50HLC
for 800-900MHz, type LC females only, flange mount

IS-CT50H78E
for 800-900MHz, flange type 7/8" EIA (sex less)

IS-PT50HN
for 890-980MHz, type N females, flange mount

IS-PT50HN-B
for 890-980MHz, type N females, -Bulkhead mount

Add suffix: **-MA** for (type N only) male antenna port (not threaded like female shown)
-ME for (type N only) male equipment port

Add $5.00 for each N male

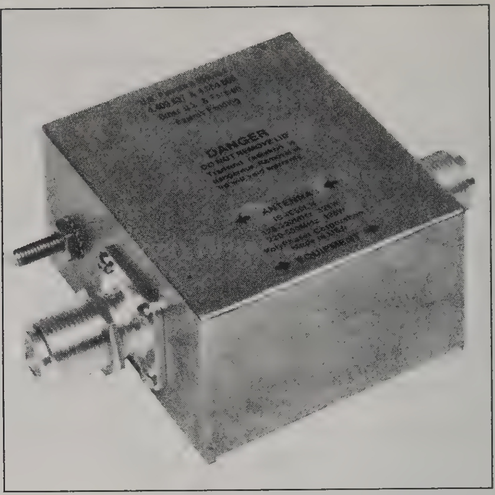
U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

PART 7 rf coupled shield/dc blocked 1.5-2600MHz

ISOLATED EQUIPMENT PORT COAXIAL PROTECTORS - BULKHEAD MOUNT

APPLICATION:

Where the best protection is a must. This most unique PolyPhaser® is one that not only has a dc block for the center conductor but also blocks the shield's surge energy from going to your equipment chassis. This is the ultimate in protection and prevents ground loops for proper single point grounding. Although pioneered and patented over 6 years ago, this type PolyPhaser® is just now gaining in popularity.

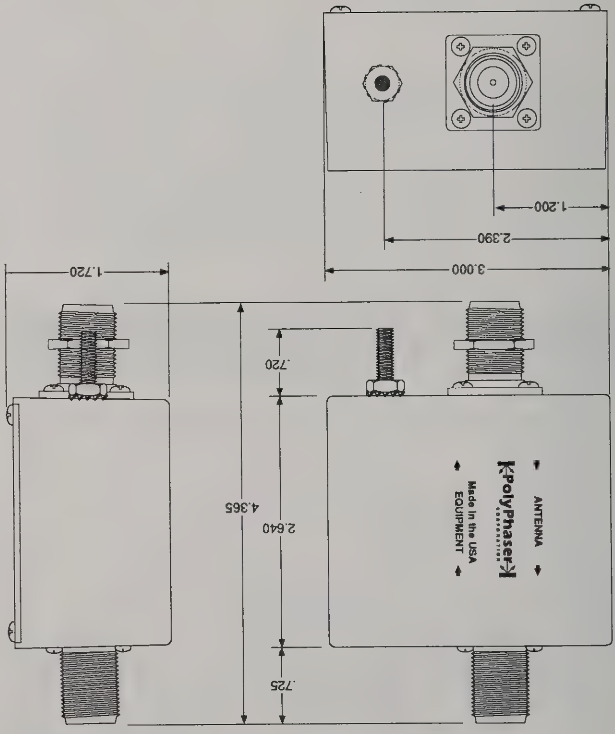


Model shown IS-IE50LN-C1

- ☐ RF coupled shield with >2kVdc breakdown
- ☐ Large bandwidths
- ☐ Transceive but not for combiner output
- ☐ Works on all equipment unlike dc continuity protectors which can't protect receivers and shunt fed cavities, etc.
- ☐ Bulkhead mounting/grounding to 1/4" thickness
- ☐ Multi-strike capability
- ☐ Low throughput energy
- ☐ Housed use only - aluminum enclosure
- ☐ 18-8 SS hardware
- ☐ UHF nickel shell, silver center, TFE
- ☐ N silver shell and gold center for low intermod generation

OPTIONS AVAILABLE: Extra connector nut, Bracket for surface mounting, EMI/RFI weather washer, Other frequency ranges, Higher power levels, VSWR and IL plots

MIL SPECS: Op to 70,000', Mil-STD-202, 107F Cond.B -65°C to 125°C, Connectors Mil-C-39012, QQ-B-626, QQ-C-530, QQ-S-365, Mil-G-45204, Solder QQ-S-571 Sn62, follows Mil-STD-454J



MAXIMUM CHARACTERISTICS

Surge:
50kA ANSI C62.1 8/20 waveform 500 Joules

Turn-on:
600 Vdc ±20% L models
1200Vdc ±20% H models

Turn-on Time:
2.5ns L; 7ns H; for 2kV/ns

VSWR:
≤1.1 to 1 over frequency range

Insertion Loss:
≤0.1dB over frequency range

Temperature:
-50°C to 125°C

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

ISOLATED EQUIPMENT PORT COAXIAL PROTECTORS - BULKHEAD MOUNT

Order: Impulse Suppressor-Isolated Equipment, ohms, pwr, N connector

UHF CONNECTORS (Females Standard)

IS-IE50LU-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-IE50HU-C0 ≤20mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 3kW, VHF 500W, UHF 250W

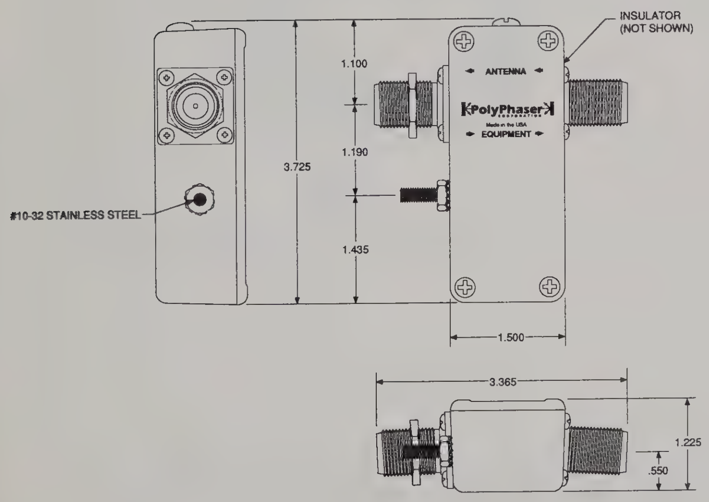
IS-IE50LU-C1 ≤600µJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

IS-IE50HU-C1 ≤1mJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 500W, UHF 250W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)

Add $10.00 for each UHF male



Model shown for Microwave only

N CONNECTORS (Females Standard)

IS-IE50LN-C0 ≤10mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-IE50HN-C0 ≤20mJ Throughput Energy
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 3kW, VHF 500W, UHF 250W

IS-IE50LN-C1 ≤600µJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 375W, UHF 125W

IS-IE50HN-C1 ≤1mJ Throughput Energy
Frequency Range: 50MHz to 700MHz
Max. Power: VHF 500W, UHF 250W

IS-IE50LN-C2 ≤220µJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 375W, UHF (low) 125W
800MHz to 1GHz 50W

IS-IE50HN-C2 ≤800µJ Throughput Energy
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 500W, UHF (low) 250W
800MHz to 1GHz 125W

IS-IEML50LN ≤1µJ Throughput Energy
Frequency Range: 1.7 GHz to 2.0 GHz
Max. Power: 100W

IS-IEMH50LN ≤1µJ Throughput Energy
Frequency Range: 2.0 GHz to 2.3 GHz
Max. Power: 100W

Choose lowest throughput energy for desired frequency
Energy based on 8/20 waveform

Add suffix: **-MA** for male connector on antenna port (not threaded like female shown)

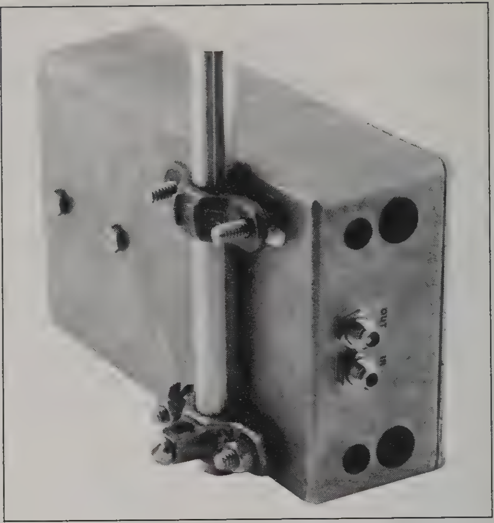
Add $5.00 for each N male

PART 8 special application - satellite dish

SATELLITE RECEIVER/LNB AND MOTOR CONTROL PROTECTORS

☐ Lowest loss and best VSWR protector available
☐ Single and dual LNB's
☐ Polarizing motor protection
☐ Three installation locations:
  Outside at dish (mounts on ground rod)
  Outside at cable entrance or indoors at receiver
☐ Power line protection for indoor location
☐ Actuator cable protection module - optional (drop-in)
☐ Box within a box all aluminum construction
☐ 18-8 SS hardware

OPTIONS AVAILABLE: Actuator drop-in protector, ±5Vdc for Polarizing Motor



Model shown IS-TVRO-P

MAXIMUM CHARACTERISTICS

RF:
- 450-1450MHz.
- 1.2 to 1 Typical VSWR
- <0.5dB IL 0.3dB Typical
- Type F-59 connectors
- 2 Stage Patented Protection
- +22Vdc - 1Vdc Turn-on 13KA

Polarizing Motor:
Two Stages, 3 wires in and 3 wires out:
  ±24Vdc at 5A, 3kA surge each

Actuator:
Optional - Two Stages, 6 wires in and 6 wires out:
  Motor lines ±36Vdc at 10A, 20kA surge each
  Supply line ±15Vdc, 2.5kA surge
  Pulse line ±15Vdc, 2kA surge
  Protected static ground 18kA surge
  Chassis ground or earth ground

Power Line:
In-line protector 15A, EMI/RFI filtering, 20kA surge

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

Model shown IS-PLTVRO-2

Order: For The Dish: (outdoor use)
IS-TVRO-P One LNB, Polar Motor
IS-TVRO-2 Two LNB's, No Polar Motor
IS-TVRO-2P Two LNB's Polar Motor
Option: **IS-AM36V** Drop-in Actuator module fits any above

For Indoors:
IS-PLTVRO-P Power line protector plus IS-TVRO-P
IS-PLTVRO-2 Power line protector plus IS-TVRO-2
IS-PLTVRO-2P Power line protector plus IS-TVRO-2P
Option: **IS-AM36V** Drop-in Actuator module fits any above

SATELLITE RECEIVER/LNB AND MOTOR CONTROL PROTECTORS

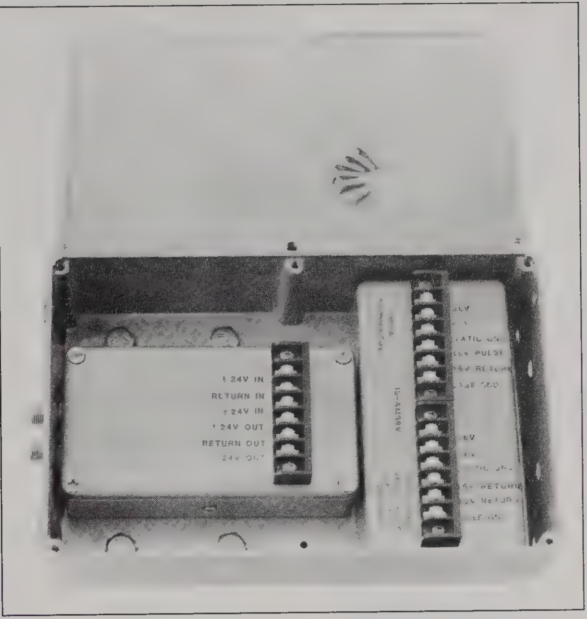
DISH PROTECTION

By interconnecting 8-foot ground rods, a lightning rod/ground rod can be constructed to protect the dish from direct strikes.

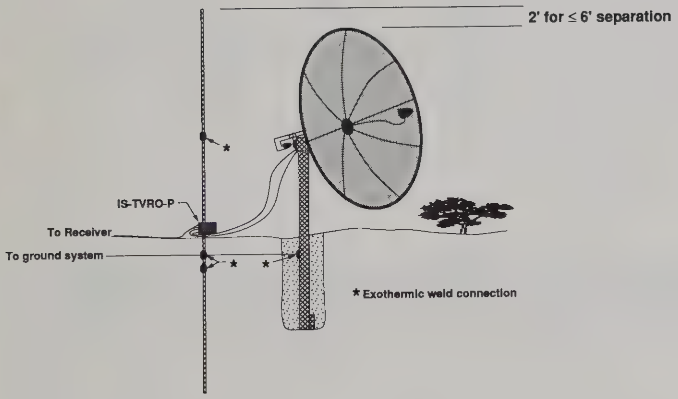
A typical installation needs to have a protector at the dish and at the receiver/actuator. This protector should be grounded along with an ac power line protector to the ground system as shown.

It is important to tie back to the power utility ground connection via a #6 or larger bare buried ground wire. Unless the dish ground is connected to ground rod "H", hum bars (ground loop) will occur.

For more information on grounding, order PolyPhaser's book "The 'Grounds' for Lightning & EMP Protection."



Lid removed to show connection for LNB, polar motor and actuator.

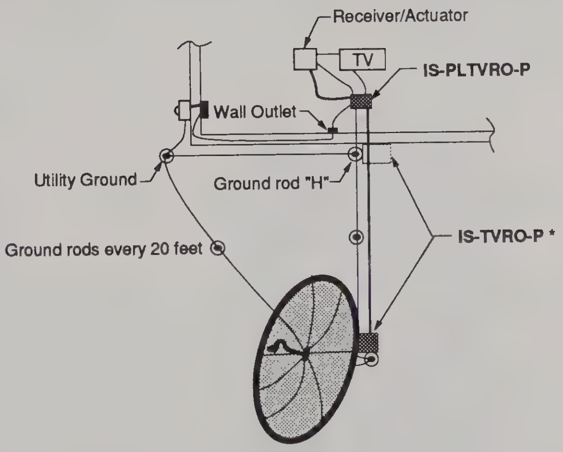


DISH PROTECTION

U.S. Patent #'s 4,359,764, 4,409,637, 4,554,608 Canadian Patent # 1,185,314 and other U.S. and Foreign Patents Pending.

TYPICAL INSTALLATION

If an existing power line protector is grounded to ground rod "H", then an IS-TVRO-P (or the same type unit as is used at the dish) should be mounted at ground rod "H", in lieu of the IS-PLTVRO-P unit inside the house.



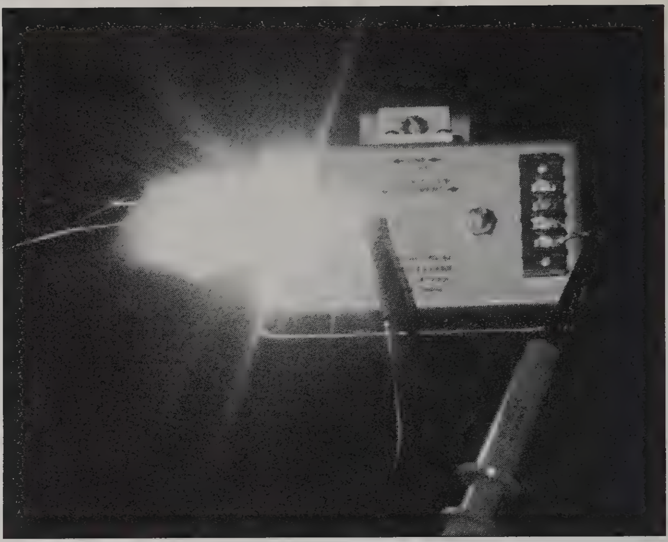
Either have an IS-TVRO-P or an IS-PLTVRO-P. Either should be grounded to ground rod "H".

PART 9 twisted pair/cable protectors

IN-LINE TWISTED PAIR PROTECTORS

APPLICATION:

From T1, Data, current loop for measurement and control, extension lines, to telephone trunk lines: Single, Double and Six Pair Protectors that can handle surges up to 36 or 40kA which can vaporize 24AWG wire without having damaging let through voltages.



☐ **Multi-stage protectors**
☐ **Large data bandwidths**
☐ **Low resistance on current loops**
☐ **Fast response times - EMP rated**
☐ **Low let through voltages**
☐ **Shielded fire proof enclosure**
☐ **Easy - positive floating plate screw connections**
☐ **Convenient ground stud for cable shield grounding**
☐ **Single and Dual pair mounts on IS-MSRP panel** (see page 36)
☐ **Flange mounting/grounding**
☐ **Housed use only**
☐ **18-8 SS hardware**

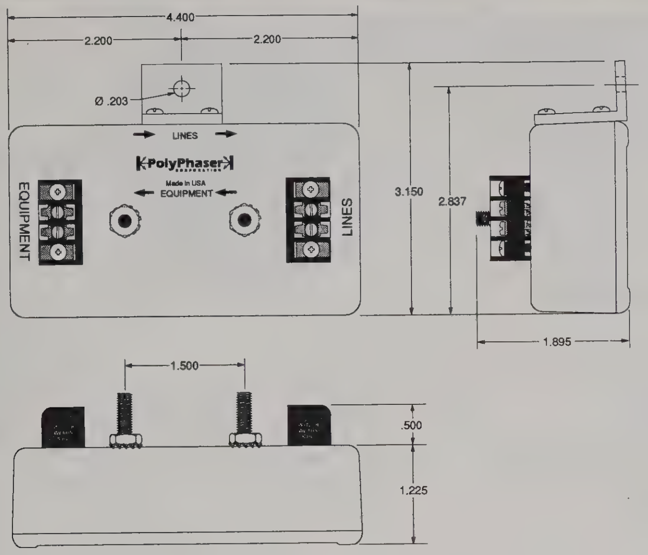
OPTIONS AVAILABLE: Other voltages, Mil screen room penetration, can be made to meet many 202 or 810 specs, higher ring voltages, T1 models to handle dc power for repeaters

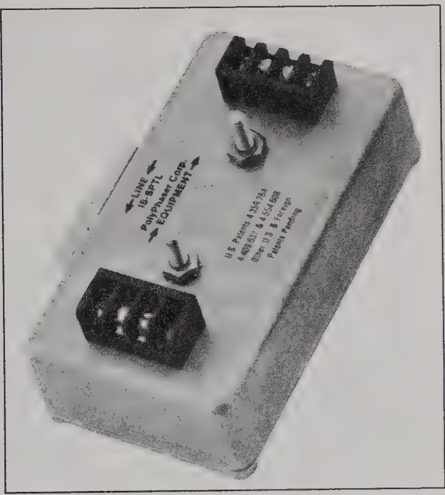
MIL SPECS: Call with requirements

MAXIMUM CHARACTERISTICS

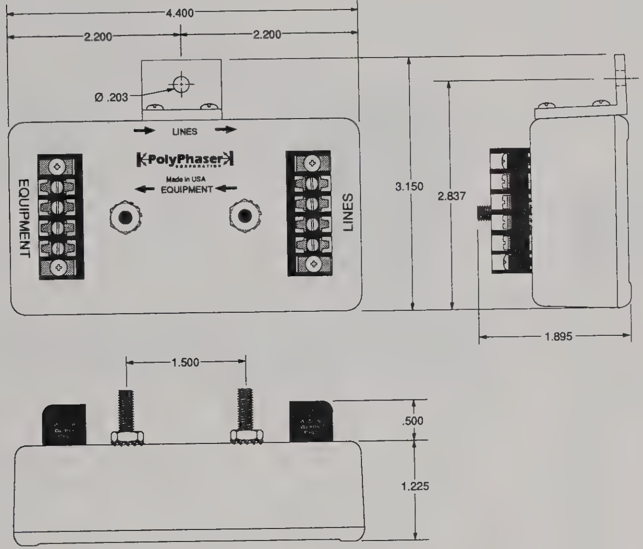
Application:	Surge:	Turn-on:	R	C	J	Let-through	BW	Models: (Single/Dual/Six Pair)
T1 Data	36kA	±7Vdc	1Ω	30pF	425J	17Vp	95MHz	---- IS-T1 IS-3T1
RS232/422 Data	36kA	±17Vdc	1Ω	30pF	425J	24Vp	95MHz	IS-SPDDL IS-DPDDL IS-6PDDL
Current Loops	36kA	±24Vdc	<0.1Ω	30nF	425J	35Vp	>30MHz	IS-CLSP IS-CPDP IS-CL6P
Extension Lines	40kA	±68Vdc	20Ω @ 1%	11nF	550J	100Vp	Audio	IS-SPXL IS-DPXL IS-6PXL
Telco Trunks (Handles standard ring voltages to 105Vrms)	40kA	±200Vdc	20Ω @ 1%	2.4nF	550J	300Vp	Audio	IS-SPTL IS-DPTL IS-6PTL

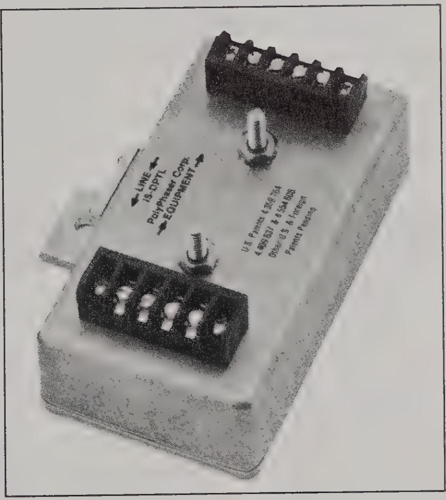
IN-LINE TWISTED PAIR PROTECTORS



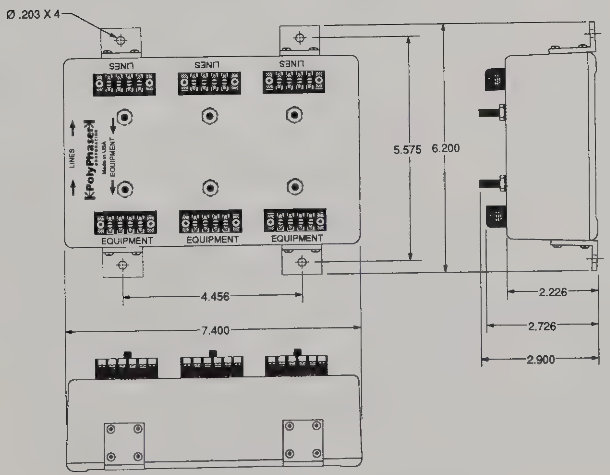


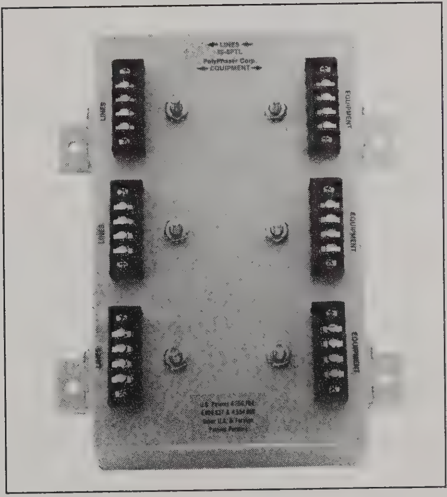
Model shown IS-SPTL





Model shown IS-DPTL



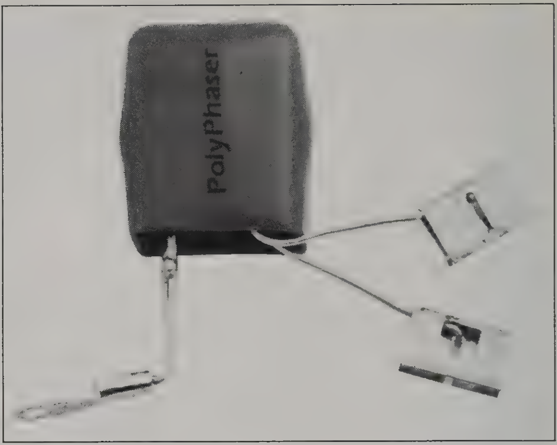


Model shown IS-6PTL

MULTI-LINE SOLID STATE TWISTED PAIR PROTECTORS

APPLICATION:

For more than 6 pair on 66 blocks or KRONE blocks, these protectors replace gas tubes and have many advantages.



Model shown IS-MPT-200

- ☐ Fast response time
- ☐ Balanced turn-on voltage
- ☐ Three voltage for 66 type
- ☐ Lower differential voltage than 3 element gas tubes
- ☐ Lower harmonic energy than gas tube
- ☐ Clamps surges
- ☐ No fast dv/dt slew like crow bar tube action
- ☐ Fails in shorted mode like gas tubes
- ☐ Easily replaced if necessary, test with FIST-4 (see page 42)
- ☐ Balanced MOV type common mode protector
- ☐ One unit = one pair protector
- ☐ Stagger mount on 66 block for >8 lines (66 block not included)
- ☐ Adjustable ground bus for 66 block

OPTIONS AVAILABLE: IS-MPT units without bridging clip

MIL SPECS: Many - call with requirements

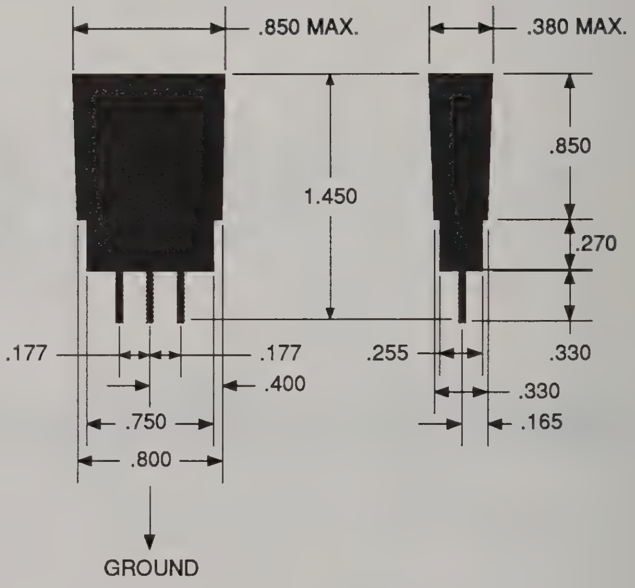
MAXIMUM CHARACTERISTICS

Surge Per Pair:
4kA IS-MPT-17 (60 Joules)
4kA IS-MPT-75 (72 Joules)
13kA IS-MPT-200 (160 Joules)
13kA IS-AMPT-250 (160 Joules)
ANSI C62.1 8/20 waveform

Turn-on:
±17 for IS-MPT-17
±75 for IS-MPT-75
±200 for IS-MPT-200
±250 for IS-AMPT-250

Turn-on Time:
2.5ns for 2kV/ns

Capacitance L to G:
27nF for IS-MPT-17
5nF for IS-MPT-75
1.6nF for IS-MPT-200
900pF for IS-AMPT-250

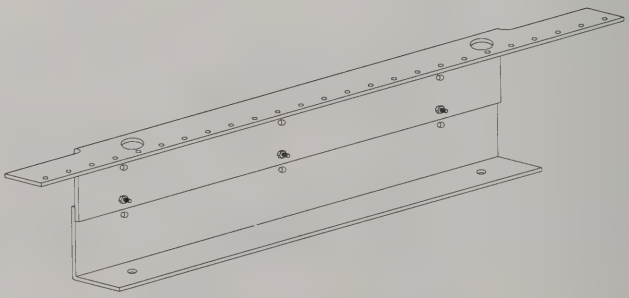


Model shown IS-AMPT-250

Order: **IS-MPT-17** for data lines on 66 blocks
IS-MPT-75 for extension lines on 66 blocks
IS-MPT-200 for trunk lines on 66 blocks
IS-AMPT-250 for gas tube replacement on KRONE blocks

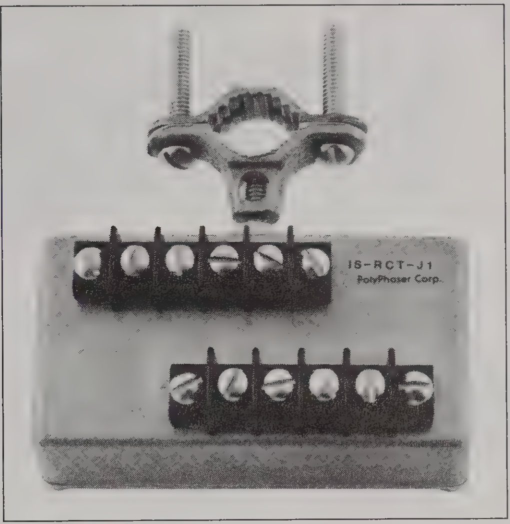
Ground Bus for 66 block

Order: **25P10GB** for 25 pair 10" 66 block
adjustable for 66 blocks with and without stands



Model shown 25P10GB

ROTOR CONTROL 8 LINE PROTECTOR WITH SCREW TERMINALS



Model shown IS-RCT-J1

APPLICATION:

For protecting up to 8 line rotor controllers, helps protect motors, control box and other nearby equipment from damage by preventing strike energy from entering room.

- ☐ EMP rated
- ☐ Faster than gas tubes
- ☐ Lower turn-on than gas tubes
- ☐ Shunt type device for up to 8 lines
- ☐ Water tight - non potted
- ☐ Aluminum enclosure
- ☐ 16 crimp/solder lugs
- ☐ Stainless steel mounting stud
- ☐ Available with bronze clamps for mounting on ground rods and tower legs

OPTIONS AVAILABLE: Other voltages, In-line type protector, Larger bronze clamps

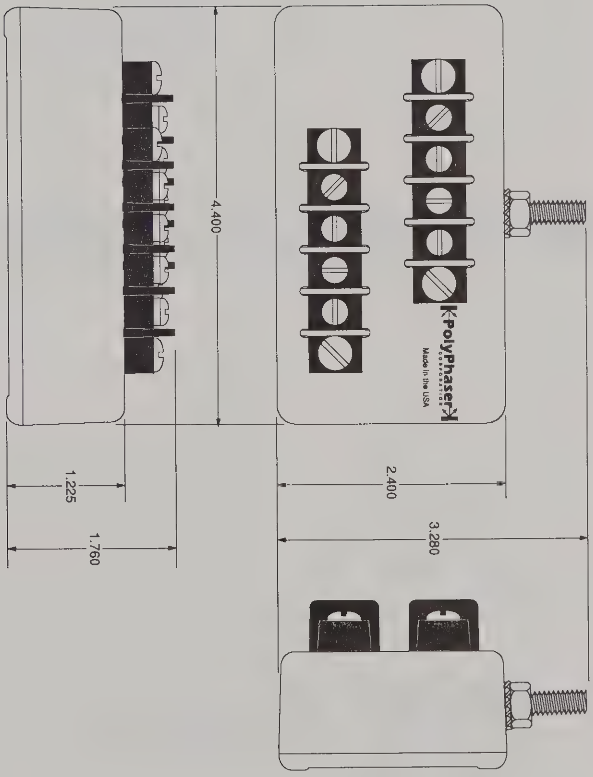
MAXIMUM CHARACTERISTICS

Surge:
2kA (each line) ANSI C62.1
8/20 waveform 26 Joules

Turn-on:
±35Vdc ±10%

Turn-on Time:
<4ns

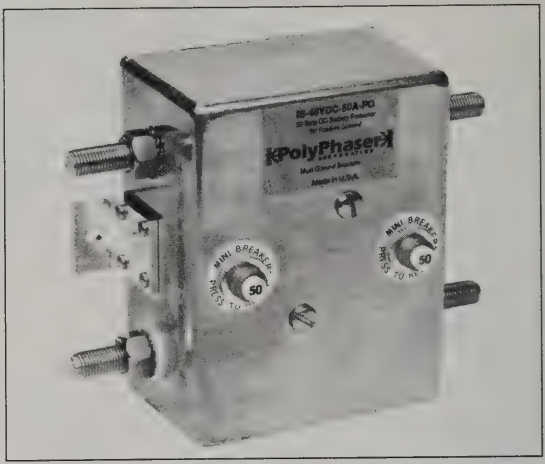
Temperature:
-50°C to 125°C



Order: IS-Rotor Control Terminals - J clamp, size #

IS-RCT for protector with no J clamp
IS-RCT-J1 for unit mounting 1/2" to 1-1/3" diameters
IS-RCT-J2 for unit mounting 1-1/2" to 2-1/4" diameters

DC BATTERY POWER PROTECTORS



Model shown IS-48VDC-50A-PG

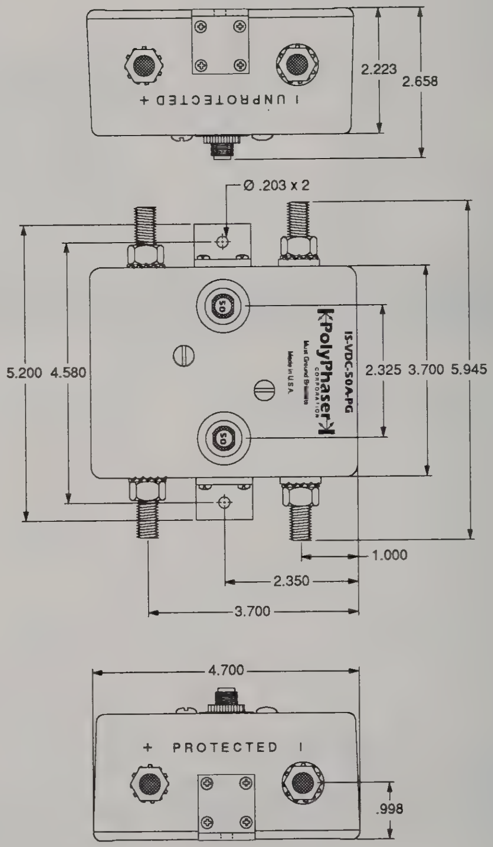
APPLICATION:

Solar panels can capture large amounts of nearby strike energy due to their large area of traces. These protectors prevent this energy from entering the hut and protect the regulator.

- ☐ Protects series pass and relay type regulators to 50A
- ☐ Has head room for open circuit arrays and battery surface charge
- ☐ Positive and negative grounds types
- ☐ Circuit breakered for added protection
- ☐ Low resistance/voltage drop
- ☐ Housed use only
- ☐ Aluminum enclosure
- ☐ 18-8 SS hardware

OPTIONS AVAILABLE: Floating ground units for all voltages -different enclosure, Units with no circuit breakers, Units with breaker on protectors only with relay output for remote status, Lower current models, Filtering for automotive applications

MIL SPECS: Call with requirements



MAXIMUM CHARACTERISTICS

Surge Per Pair:
18kA ANSI C62.1 8/20 waveform

Turn-on:
17Vdc for IS-12VDC
24Vdc for IS-17VDC
35Vdc for IS-24VDC
53Vdc for IS-35VDC
-62Vdc for IS-48VDC
-80Vdc for IS-60VDC

Turn-on Time:
<2ns

Resistance:
0.02 ohms

Connections:
3/8-24 SS studs

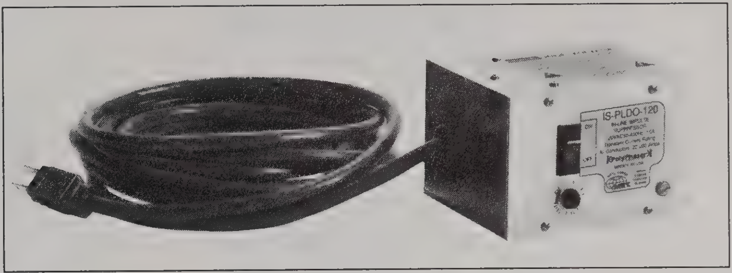
Order: IS-Voltage dc, -Ampere current,
-Positive/Negative ground

BASIC UNITS:	ADD SUFFIX:
IS-12VDC-50A	**-NG** (Negative Ground)
IS-17VDC-50A	**-PG** (Positive Ground)
IS-24VDC-50A	
IS-35VDC-50A	
IS-48VDC-50A	
IS-60VDC-50A	

POWER LINE EXTENSION PROTECTORS - 120/240Vac

APPLICATION:

Where equipment needs require power line protection for surges/lightning this unit will provide proper protection, filtering and grounding since it has an all metal grounded enclosure.



Model shown IS-PLDO-120

- ☐ NRTL listed - #1449
- ☐ In-line multi-stage (EMP rated) protectors
- ☐ All aluminum grounded enclosure/panel for lower inductance
- ☐ Multi-strike capability
- ☐ Extra long 15 foot SJT type cord - for 120Vac unit
- ☐ Circuit breakered for added protection
- ☐ Master on/off switch
- ☐ Can be mounted/grounded to a single point ground plate
- ☐ Crimped/soldered terminal construction for reliability
- ☐ Duplex outlet adaptable to six outlets
- ☐ Matched MOV design for best clamping/energy handling

Order:
IS-Power Line Duplex Outlet-voltage-Ampere current

IS-PLDO-120-15A	for 120 Vac with 15' cord
IS-PLDO-120-20A*	for 120 Vac with 6' cord
IS-PLDO-240-10A*	for 240 Vac with 10' cord

Sixplex - for 120Vac duplex to six outlet adaptor

Models with many international plugs and outlets available - call for information.

* Not NRTL listed

MAXIMUM CHARACTERISTICS

Surge:
20kA ANSI C62.1 8/20 waveform 800 Joules (120)
1.4k Joules (240)

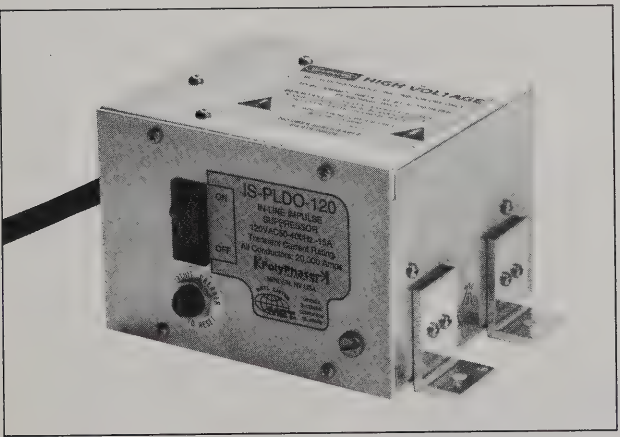
Turn-on:
200 Vdc (120), 370Vdc (240)

Turn-on Time:
Not defined due to filtering

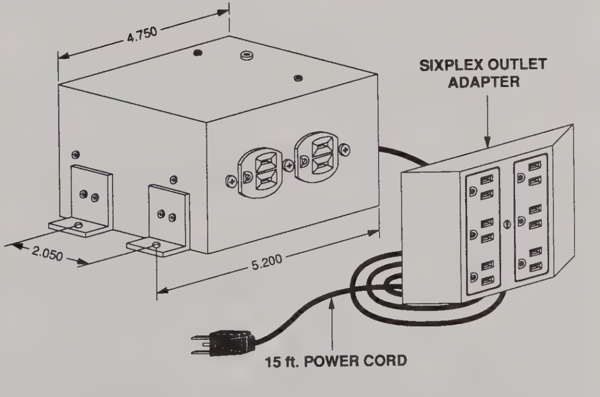
EMI/RFI Filtering: (Measured to Mil-STD-220)
-50dB @ 500kHz
-55dB @ 70MHz
-45dB @ 140MHz

Surge Let Through Voltage:
(ANSI C62.1 8/20 waveform)
400Vp-10kA, 600Vp-20kA (120)
700Vp-10kA, 1000Vp-20kA (240)

Usage Current:
15A



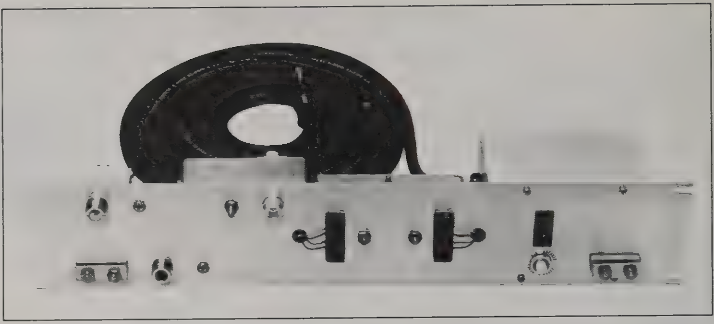
Model shown IS-PLDO-120



PART 11 ac power 120-240V 10A-20A

MULTI-SUPPRESSOR RACK PANEL WITH BUILT-IN POWER PROTECTOR

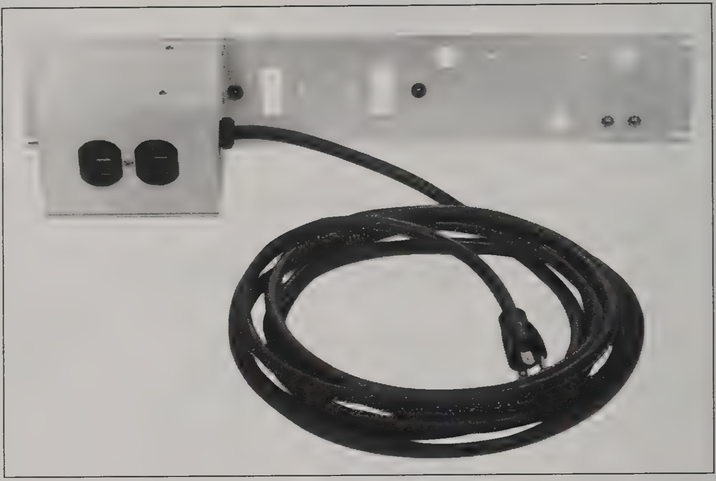
APPLICATION:
Where a bulkhead panel can't be installed and a rack of equipment must be protected. All inputs and outputs should have protection and be grounded in common with the rack.


Model shown IS-MSRP-120 (front) fully loaded

- ☐ Provides a low inductance, single point grounding location
- ☐ Standard 19" rack size by 3.5" high and 1/8" aluminum
- ☐ Has IS-PLDO-120 built on the panel
- ☐ Brass blocks sandwich 1-1/2" copper strap for grounding
- ☐ Mounts up to three coaxial protectors
- ☐ Mounts either single or dual twisted pair protectors

OPTIONS AVAILABLE: 240Vac @ 10A

SEE PAGE 35 FOR TECHNICAL INFORMATION ON IS-PLDO-120

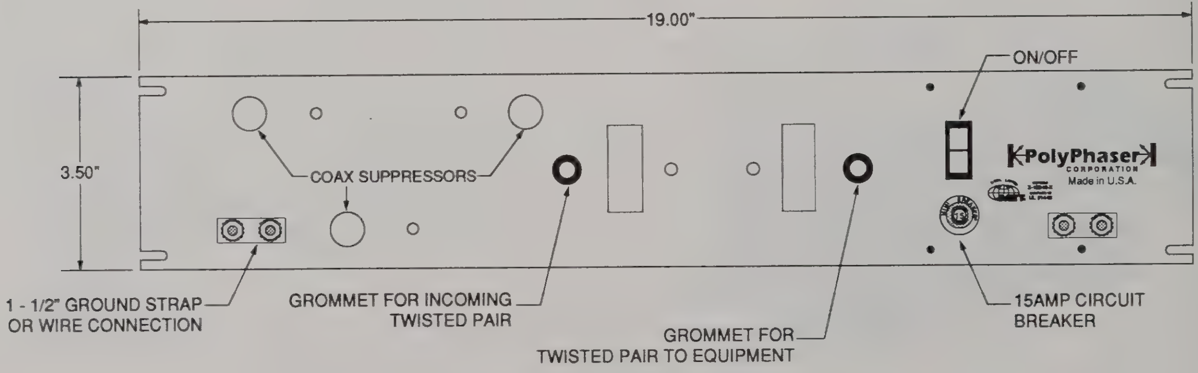

Model shown IS-MSRP-120 (back) as purchased

You may mount any three models from Group A or any two models from Group A and one model from Group B or any two models from Group B with any one model from Group A.

NOTE: You may ***not*** have all three models from Group B.

GROUP A	GROUP B
IS-B50	ANY BOX TYPE
IS-NEMP	ALUMINUM ENCLOSURE PROTECTOR

Note: Female type connectors only.


19.00"
ON/OFF
3.50"
COAX SUPPRESSORS
PolyPhaser CORPORATION
Made in U.S.A.
1 - 1/2" GROUND STRAP OR WIRE CONNECTION
GROMMET FOR INCOMING TWISTED PAIR
GROMMET FOR TWISTED PAIR TO EQUIPMENT
15AMP CIRCUIT BREAKER

POWER MAINS INFORMATION

There are many ways in which your equipment can get zapped via the power line. The obvious is a strike down the road which induces a surge on the power lines. However a strike to your tower or a coupled surge to the phone lines can also get your equipment because the power line can provide a different path to ground. To ensure survival, all inputs and outputs (I/O's) must not only be protected but must be bonded in common via a common low inductance path to an earth ground. All grounds should be bonded in the earth to form a single earth system.

Power mains protectors are to be placed at the entrance panels, transfer switches or distribution panels. They should have a low inductance path to earth system and be installed with the minimal lead inductance (short with gradual bends). For best protection, have an additional in-line power protector at or very near the sensitive equipment. This can not be a protector that only uses the wall outlet's grounding means, for it is too inductive to be much good. It should be a protector that can be mounted/grounded (like the IS-PLDO or IS-MSRP) to your main earth system.

TYPES OF POWER MAINS CONFIGURATIONS

Power mains come in several different configurations. The three basic ones are single, bi-phase, and three phase. Three phase is sometimes called poly phase and has further divisional classes using the letters "Y", written "Wye", and "Δ", the Greek letter Delta.

SINGLE PHASE

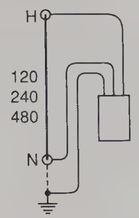
This is the simplest. It has a hot, a return called a neutral, and a safety ground. This is commonly used for secondary wiring for a normal outlet. It may be any world wide standard voltage. For the US, it is 120Vac (see drawing).

BI-PHASE

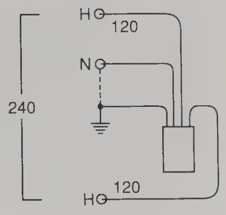
This is a common feed configuration. It may be obtained by either a single transformer, center tapped or by grounding one phase of a three phase delta. The former is often mis-called single phase in the US since it often uses a single, center tapped, transformer fed from one of three high line phases. These phases are 180 degrees from each other thus 120Vac and 120Vac are available as well as 240Vac. This is typical for most houses in the US (see drawing).

POLY PHASE OR THREE PHASE

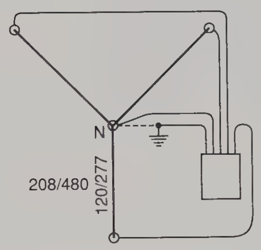
This is the feed for large facilities. The phases are 120 degrees apart. The wye configuration normally always has a neutral/return which is grounded. The true delta (called a closed delta) normally does not have a ground. There is an open delta where a high leg (red lead) has a higher voltage to ground than the rest and there is a ground lead. A grounded delta has one leg grounded (see drawings).



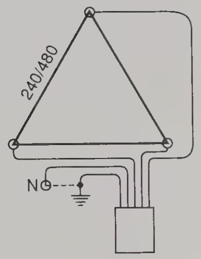
SINGLE PHASE (SP)
120, 240 or 480VAC



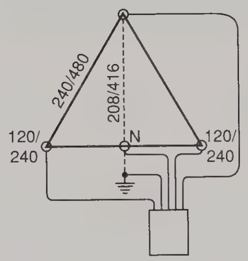
BI-PHASE



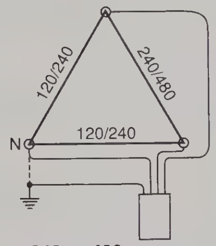
120/208 or 277/480 WYE (Y)



240 or 480 DELTA (D)



240 or 480 OPEN DELTA (O)



240 or 480
GROUNDED DELTA

VOLTAGES AVAILABLE AND WHERE USED

Voltages to 480Vac are used for normal feeds. The voltages will depend on the type of feed you have and on your country. Some places use different voltages than others. If you measure the phase to phase voltages and the phase to ground voltages, you will be able to determine the type of service you have. You will then need to look to see the current rating on the (largest) cutoff breaker.

CONNECTIONS FOR PROTECTORS

The connections for the protectors are given for each model and service type. Only the voltages change. The wires are properly color coded for identification.

SHUNT OR IN-LINE; WHERE TO USE EACH

In-lines are load bearing; shunt types are not. In-lines are presently available to 400A. These have redundancy, better surge limiting and provide filtering. Shunt types have no real load current limit however the larger the load, the larger the wires, and the more the surge energy will follow the lines with the largest surface area. This means that more than one protector should be used. With some 20' separation (shielded) between protectors, they will almost equal a single in-line protector. Both types have alarm contacts and field replaceable surge components.

POWER MAINS SHUNT TYPE LINE PROTECTOR

APPLICATION:

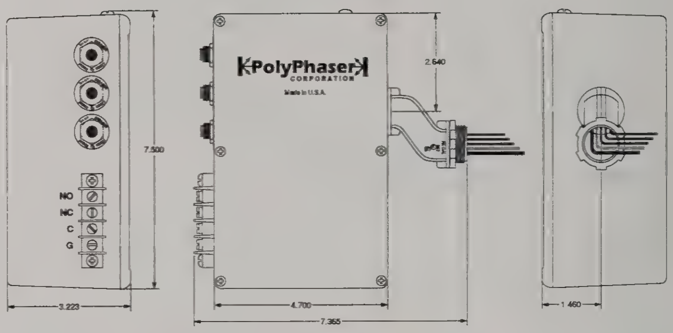
For building entrances where lightning energy may be shunted to an outside ground before it enters the building. The distance between the entrance and a sensitive electronic load should not be more than 10' unless another (in-line) protector is also being used.

Model shown IS-PM208-3Y

- ☐ Single, bi and three phase
- ☐ 120, 208/240 and 480Vac
- ☐ Surge energy is shunted to ground not to neutral
- ☐ Remote/local status contacts
- ☐ Breakered internally for safety - won't interrupt load power
- ☐ Field replaceable protection blocks - if needed
- ☐ UL listed components
- ☐ Housed use only

OPTIONS AVAILABLE: 377Vac models available, lights, longer wire lengths

MIL SPECS: Many - Call with requirements



MAXIMUM CHARACTERISTICS

Surge:
40kA per phase ANSI C62.1 8/20 waveform (see Joule table)

Turn-on Time:
≤25ns for full lead length 2kV/ns

Temperature:
-40°C to 71°C

Order: Impulse Suppressor-Power Mains, voltage-phase and type

Order Model:

120 Vac	240 Vac	480 Vac	Phase Type
①**IS-PM120-SP**	③**IS-PM240-SP**	⑥**IS-PM480-SP**	Single-phase (Foreign)
---	①**IS-PM240-BP**	⑤**IS-PM480-BP**	Bi-phase (U.S.)
---	②**IS-PM240-3D**	⑧**IS-PM480-3D**	3-phase Delta
---	②**IS-PM208-3Y**	⑧**IS-PM480-3Y**	3-phase Wye
---	④**IS-PM240-3O**	⑦**IS-PM480-3O**	3-phase Open Delta

Total surge energy in joules per unit:
①1040J ②1560J ③1720J ④2200J ⑤2400J ⑥2920J ⑦4800J ⑧5040J

Total surge current* per unit in kA:
①80kA ②80kA ③80kA ④120kA ⑤80kA ⑥80kA ⑦120kA ⑧120kA

Peak dc voltage with a 3kA surge per phase* (phase to ground):
①400V ②400V ③700V ④700/400V ⑤700V ⑥1500V ⑦900/700V ⑧700V

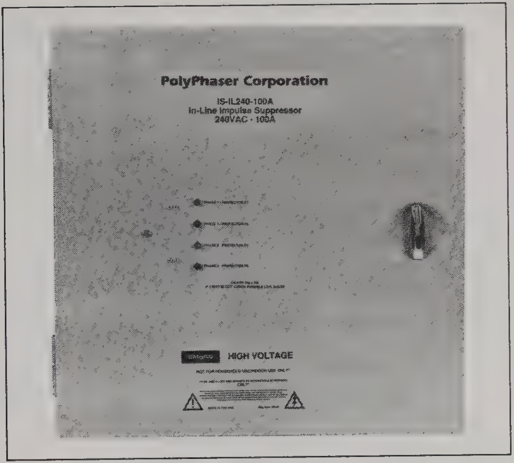
Turn on voltage (phase to ground) dc (ac):
Note: phase to phase = 2 times
①205/(145) ②205/(145) ③360/(255) ④360(255)/205(145) ⑤360(255)
⑥715(505) ⑦715(505)/425(300) ⑧425(300)

* Based on 8/20 waveform
** International voltages available - call.

POWER MAINS IN-LINE TYPE LINE PROTECTOR

APPLICATION:

Where outside originated line surges are a problem and they must be shunted and filtered to protect sensitive electronic equipment.

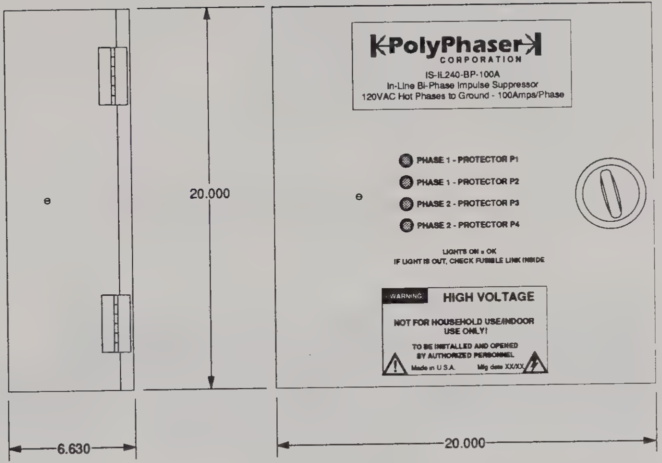


Model shown IS-IL240-BP-100A

- ☐ Single, bi and three phase
- ☐ 120, 208/240 and 480Vac
- ☐ Built-in redundancy - dual stages per phase with filtering
- ☐ Surge energy is shunted to ground not to neutral
- ☐ Front panel indicator lamps
- ☐ Remote/local status contacts
- ☐ 100, 200 ands 400A load currents per phase
- ☐ Fusible link protected - won't interrupt load power
- ☐ Field replaceable protection blocks/fuses if needed
- ☐ UL listed components
- ☐ Housed use only

OPTIONS AVAILABLE: 377Vac models available, NEMA 3 and 4X

MIL SPECS: Many - Call with requirements


20.000
PolyPhaser
CORPORATION
IS-IL240-BP-100A
In-Line Bi-Phase Impulse Suppressor
120VAC Hot Phases to Ground - 100Amps/Phase
PHASE 1 - PROTECTOR P1
PHASE 1 - PROTECTOR P2
PHASE 2 - PROTECTOR P3
PHASE 2 - PROTECTOR P4
LIGHTS ON = OK
IF LIGHT IS OUT, CHECK FUSIBLE LINK INSIDE
WARNING
HIGH VOLTAGE
NOT FOR HOUSEHOLD USE/INDOOR USE ONLY!
TO BE INSTALLED AND OPENED BY AUTHORIZED PERSONNEL
Made in U.S.A.
Mfg date XX/XX
6.630
20.000

MAXIMUM CHARACTERISTICS

Surge:
45kA per phase ANSI C62.1 8/20 waveform (see Joule table)

Turn-on Time:
Not defined due to filtering

EMI/RFI Filtering: (Mil-STD-220)
-6dB 1kHz, -20dB 1MHz, -50dB 10MHz, -60dB 20MHz per phase

Order: Impulse Suppressor-voltage-phases and type

Total surge energy in joules per unit:
①2080J ②3120J ③3440J ④4400J ⑤4800J ⑥5840J ⑦9600J ⑧10080J

Total surge current* per unit in KA:
①90kA ②90kA ③90kA ④135kA ⑤90kA ⑥90kA ⑦135kA ⑧135kA

Peak DC voltage at 45KA surge per phase* (phase to ground):
①325V ②325V ③575V ④575/325V ⑤575V ⑥1250V ⑦625/575V ⑧575V

Turn on voltage (phase to ground) dc (ac):
Note: phase to phase = 2 times
①205/(145) ②205/(145) ③360/(255) ④360(255)/205(145) ⑤360(255) ⑥715(505) ⑦715(505)/425(300) ⑧425(300)

* Based on 8/20 waveform ** International voltages available - call.

Note: See IS-PM Series for phase configurations.

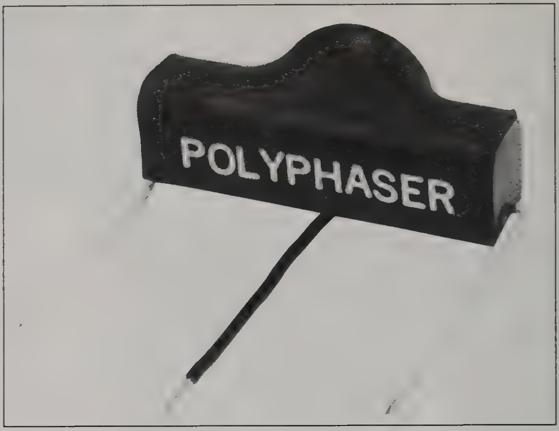
Order Model:

120 Vac	240 Vac	480 Vac	Phase Type
①**IS-IL120-SP**	③**IS-IL240-SP**	⑥IS-IL480-SP	Single-phase (Foreign)
---	①**IS-IL240-BP**	⑤**IS-IL480-BP**	Bi-phase (U.S.)
---	②**IS-IL240-3D**	⑧**IS-IL480-3D**	3-phase Delta
---	②**IS-IL208-3Y**	⑧**IS-IL480-3Y**	3-phase Wye
---	④**IS-IL240-3O**	⑦**IS-IL480-3O**	3-phase Open Delta

Note: You must add: **-100A** for 100A/phase usable power
-200A for 200A/phase usable power
-400A for 400A/phase usable power
(i.e. **IS-IL240-BP-100A**)

HARDWIRE POWER SUPPLY SHUNT PROTECTOR

APPLICATION:
Used for military equipment protection - incorporated within the equipment and properly fused or breakered.



Model shown IS-PSP-120

- ☐ Low cost
- ☐ Superior because it is referenced to your equipment
- ☐ High speed mov and high current gas tube combination
- ☐ Long life 0.84 Coulomb
- ☐ Must be locally fused/breakered (15A)
- ☐ Solder in place
- ☐ UL listed components
- ☐ 1-3/4" long #20AWG leads
- ☐ Housed use only

MIL SPECS: Many - Call with requirements

Order: Impulse Suppressor-Power Supply Protector-voltage ac

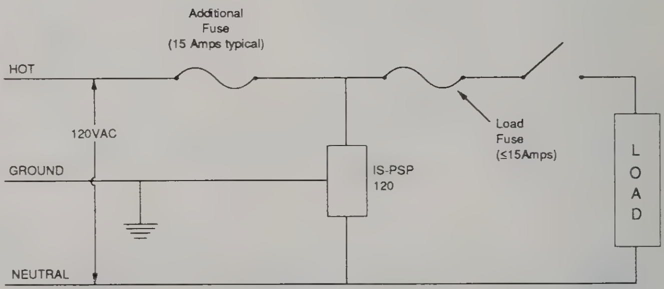
IS-PSP-120 for 120Vac
IS-PSP-240 for 240Vac

MAXIMUM CHARACTERISTICS

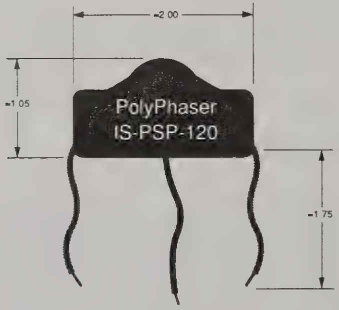
Surge: 35kA ANSI C62.1 8/20 waveform 875 Joules

Turn-on:
IS-PSP-120 ±200Vdc L to N
±300-500Vdc L to G
IS-PSP-240 ±350Vdc L to L
±500-800Vdc L to G

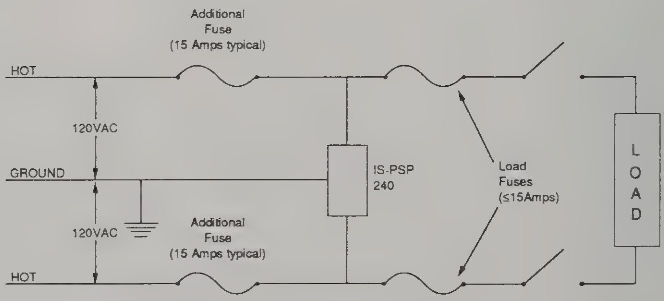
Turn-on Time: 2ns L to L, 10ns L to G for 2kV/ns



Recommended installation for IS-PSP-120.



NOTE: Same approximate dimensions for IS-PSP-240



Recommended installation for IS-PSP-240.

HIGH CURRENT/ENERGY LOW CAPACITANCE SHUNT PROTECTORS

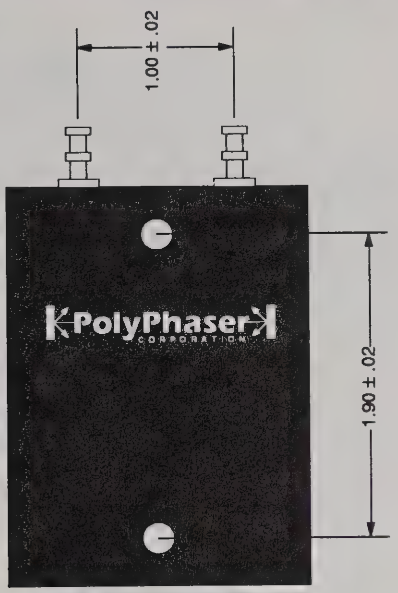
APPLICATION:

From power to high speed data lines this small package can handle up to 200kW peak pulse power. Variety of voltages and current levels available.

- ☐ Custom made
- ☐ Great clamping ratio
- ☐ Solder terminal connections
- ☐ Fast response time - EMP rated
- ☐ Large voltage and power ranges to choose from
- ☐ Watertight
- ☐ Long life
- ☐ Low profile
- ☐ Bi-directional

OPTIONS AVAILABLE: Voltages from 1.5Vdc to 225Vdc, Peak power 1.5kW to 200kW, Mil-E-16400

MIL SPECS: DOD-STD-1399, Mil-E-16400 and Mil-I-16923 with option



MAXIMUM CHARACTERISTICS

Surge:
Depends on voltage/power needed
(225Vdc=625A)
ANSI C62.1 8/20 waveform

Turn-on:
From 1.5Vdc to 225Vdc

Turn-on Time:
<10ns for 2kV/ns

Capacitance:
30pF typical

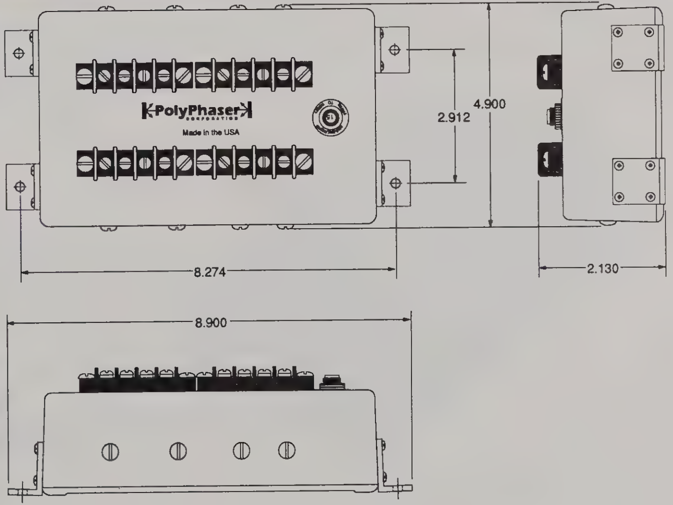
Order: IS-Low Capacitance, voltage V, current (8/20)
Example: **IS-LC200V625A**

DROP-IN TOWER STROBE FLASHER PROTECTOR

APPLICATION:

To prevent lightning energy from damaging strobe flasher and getting into power lines of building.

- ☐ Single or double strobe flasher models
- ☐ In-line protector for ac, HV, HV return, trigger and interlock lines
- ☐ Housed use only - fits inside some control boxes



Model shown IS-7WFU

MAXIMUM CHARACTERISTICS

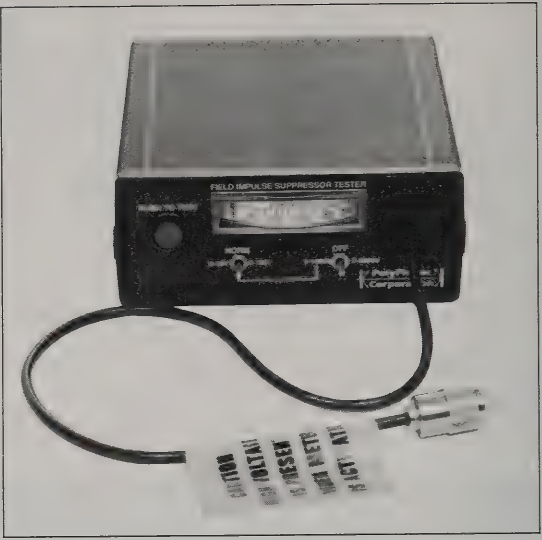
	Surge:*	Turn-on:	Usage:
ac	15kA	200Vdc	120Vac 15A
HV & return	6.5kA	2000Vdc	2000Vdc
trigger & return	10kA	400Vdc	350Vdc
interlock	15kA	200Vdc	120Vac

* (ANSI C62.1 8/20 waveform)

Order: **IS-7WFU** for single (7 wire) flasher unit
IS-12WFU for dual (12 wire) flashers unit

HIGH VOLTAGE PORTABLE BREAKDOWN TESTER

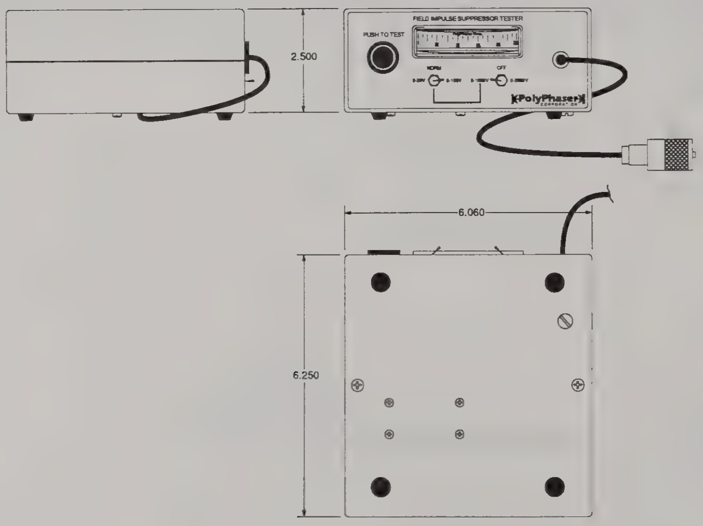
APPLICATION:
Where any Impulse Suppressor
to 2000Vdc must be tested.

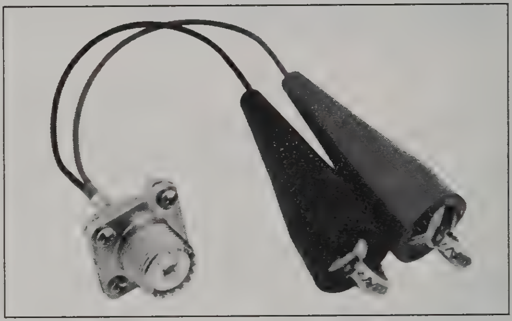


Model shown FIST-4

- ☐ Use for pass/fail for Mil-188-125 POE testing
- ☐ Runs on single, included D cell
- ☐ Reads gas tubes turn-on to ±10%-50V
- ☐ Tests mov, zeners and other SAS type protectors and can be used with your DVM for better accuracy
- ☐ Four scales - 20V, 100V, 1kV and 2kV
- ☐ Can be used as a volt meter on lower two scales
- ☐ Current limited to ≤2mA
- ☐ Safe push to test button
- ☐ Tests all PolyPhaser protectors
- ☐ How to test book, UHF to N adaptor, 6" high voltage clip leads and padded nylon case with hands free neck strap/side storage pouch included

Order: Field Impulse Suppressor Tester
-four scales
FIST-4





Clip Leads — included

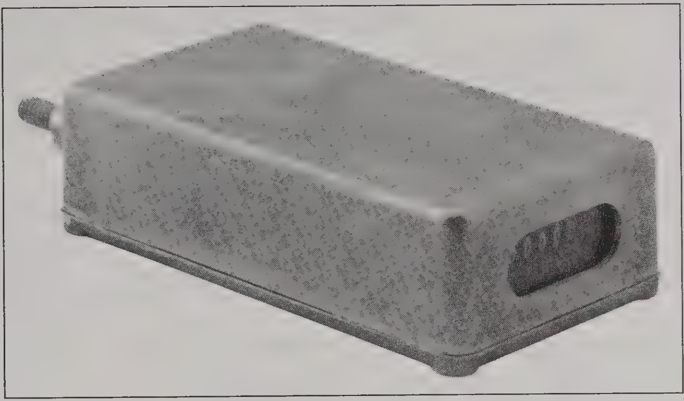
Nylon Case — included

LIGHTNING STRIKE COUNTERS FOR TOWERS, POWER & PHONE LINES

APPLICATION:

To determine where strike energy is occurring, For preventive maintenance and testing of protectors, To show how many times your PolyPhasers® have protected your equipment.

- ☐ Three application oriented models
- ☐ Strike powered- no batteries or power supplies
- ☐ Internally protected
- ☐ Counts to 999,999

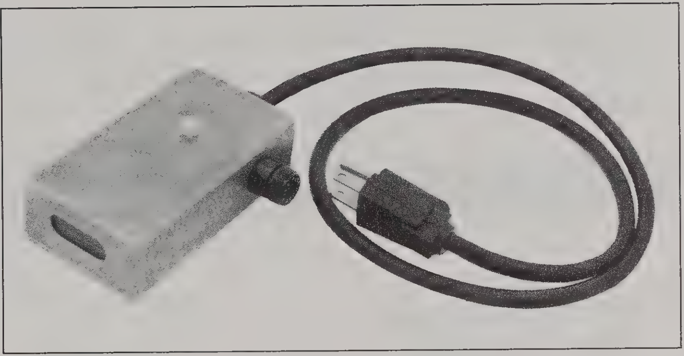


Model shown LSC-10

LSC-10 TOWERS, PIPELINES, LIGHTNING DOWN CONDUCTORS

- ☐ Uses the tower etc. as an inductive shunt; voltage drop across the shunt triggers the counter
- ☐ Requires an electrical connection spaced 6-10' for Rohn 25 larger spacing for larger towers. The larger the separation the greater the sensitivity
- ☐ Use a #14 or larger wire gauge for connections with TK clamps for corrosion free joints
- ☐ Momentary test with either polarity battery from 9V to 50V
- ☐ Waterproof may be left out doors but do not open!

Order: **LSC-10**



Model shown LSC-20

LSC-20 120Vac POWER LINES

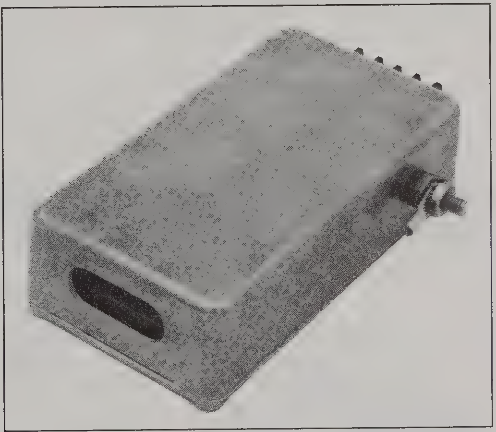
- ☐ Plugs into wall outlet with 20" line cord
- ☐ Surge protected and fused
- ☐ Records surges >200Vp with 1 Joule of energy
- ☐ Will not count noise or voltage fluctuations
- ☐ Working indicator light on top
- ☐ Housed use only

Order: **LSC-20**

LSC-30 PHONE LINES

- ☐ Bridges across phone line
- ☐ Counts common and differential surges when grounded
- ☐ Records surges >200Vp with 1 Joule of energy
- ☐ Will not interfere with line

Order: **LSC-30**



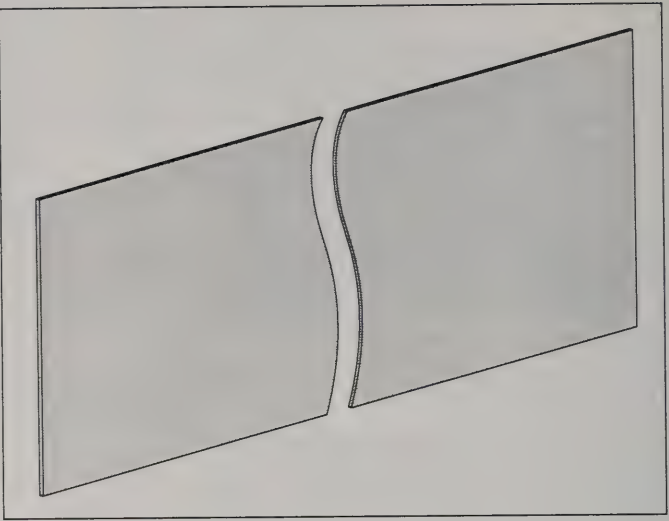
Model shown LSC-30

LOW INDUCTANCE COPPER INTERCONNECT STRAP

APPLICATION:

Where any wire ground path is used the copper strap will have lower inductance. Radials on bare mountain tops - the strap's sharp edge will allow a lower voltage side flashing to the bare rock than wire.

- ☐ Lower inductance than wire
- ☐ 1.5" strap has a lower inductance than #2/0 stranded wire
- ☐ Easy to work with (cut, solder, etc)
- ☐ Sold by the foot up to 450' lengths
- ☐ 26 AWG thickness (.0159")
- ☐ Can not be fused open by lightning
- ☐ Above or in ground usage
- ☐ Can be sandwiched for exothermic welding
- ☐ Can be used with TK series clamps (see page 45)
- ☐ 1-1/2" can be used with new strap connector clamps (see page 45)



Order: **1.5" STRAP** for 1.5" Copper Strap
3.0" STRAP for 3.0" Copper Strap
6.0" STRAP for 6.0" Copper Strap

CHARACTERISTICS

	1.5" STRAP	3.0" STRAP	6.0" STRAP
Cross sectional area in square inches	.0239	.0478	.0956
Closest stranded wire size to the above area	#6 AWG (.02062)	#3 AWG (.04134)	#2/0 AWG (.1045)
Inductance of wire for eight feet	3.362 µH	3.194 µH	2.961 µH
Inductance of strap for eight feet	2.067 µH	2.273 µH	1.940 µH
% decrease of inductance of strap over wire for eight feet	22.5%	28.8%	34.5%

NOTE: 1.5" strap has lower inductance than #2/0 AWG cable.

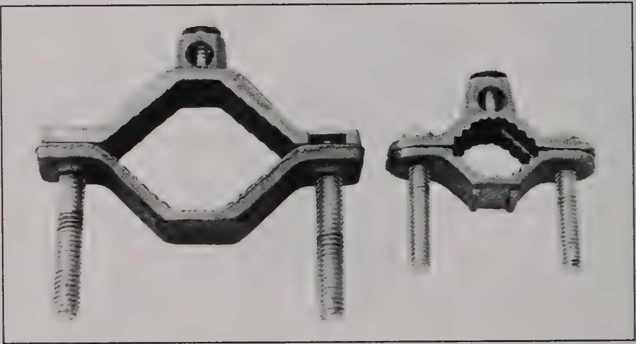
BRONZE TRANSITION CLAMPS WITH ALL STAINLESS SCREWS

APPLICATION:

Can be used to bond wire to ground rods, fire risers, etc.

- ☐ Two adjustable sizes
- ☐ Cast bronze
- ☐ 18-8 stainless screws
- ☐ For wire sizes #2 stranded to #10 solid

Order: **J-1** for 1/2" to 1-1/3" diameters
J-2 for 1-1/2" to 1-1/4" diameters

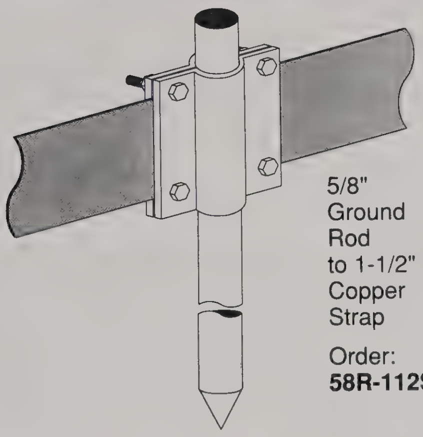


NEW CLAMP BONDS

APPLICATION:

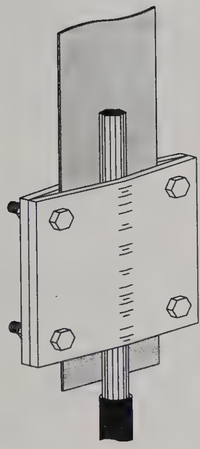
To bond copper strap without having to build up the joint for an exothermic weld.

- ☐ Faster installation than exothermic welding
- ☐ Copper to copper will not corrode
- ☐ <.0001 ohm resistance
- ☐ All copper sandwich with 18-8 stainless hardware
- ☐ Large contact surface which smashes the strap into place
- ☐ Joint compound included
- ☐ Can be used for 1-1/2" to 6" copper strap
  (see page 61 for applications)



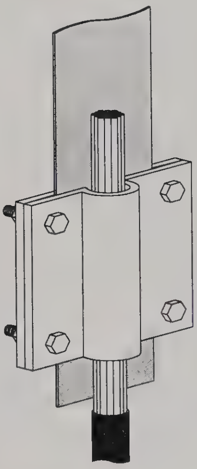
5/8" Ground Rod to 1-1/2" Copper Strap

Order: **58R-112S**



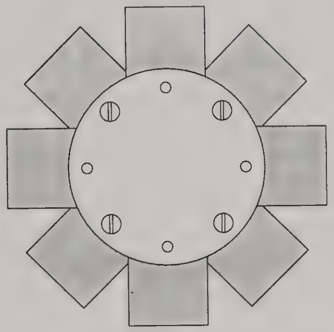
6 to 1 AWG to 1-1/2" Copper Strap

Order: **1C-112S**



2/0 AWG to 4/0 AWG to 1-1/2" Copper Strap

Order: **20C-112S**



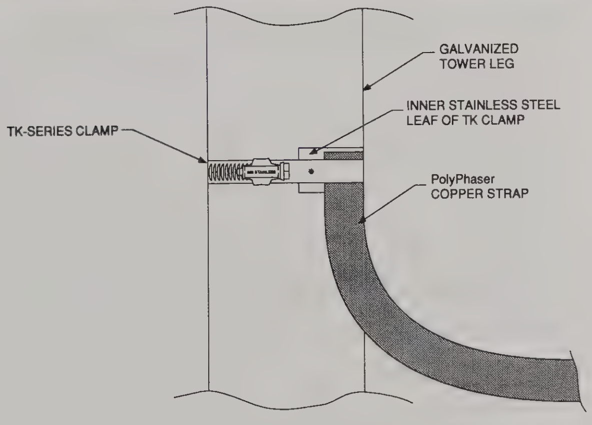
1-1/2" or 3" Multi Copper Strap

Order: **MSC-3**

COPPER TO TOWER LEG CORROSION FREE GROUND CLAMPS

APPLICATION:

To provide a good connection of copper wire or strap to galvanized tower leg, without any corrosion and without the worry of exothermic welding to your tower structure.



- ☐ <1 milliohm typical contact resistance
- ☐ Marine quality 100% 300 stainless
- ☐ Clamps copper wire or strap
- ☐ No dissimilar metal corrosion
- ☐ Less expensive than bronze clamps
- ☐ 4 models from 5/8" to 5"
- ☐ Can be joined together for even larger sizes

Order:	**TK-1**	5/8" to 1-1/4"	1-1/2" (tapered) strap to ground rod
	TK-2	1-1/4" to 2-5/16"	1-1/2" strap to Rohn 25, 45 and 65 tower legs
	TK-3	2-5/8" to 3-3/4"	1-1/2" strap to water mains
	TK-4	3-1/2" to 5"	3" strap to fire raisers/tower legs

COMPLETE ACTIVE SALT GROUNDING SYSTEMS

APPLICATION:
Where ground conductivity is poor and/or parcel size prevents installation of properly sized radials to insure an absorptive, low impedance grounding system.

☐ Replenishes naturally occurring salts that may have been leached over time from the upper soil layers by rainfall

☐ Easier and cleaner to install than graphite powder

☐ Unlike graphite, salt with water will make the ground surrounding the PolyRod a better conductor and a good earth connection

☐ Epsom salt is sold in drug stores and can be taken internally in small quantities. This is the same salt used in the PolyRod and will not kill most plants or grasses

☐ Makes a good conductive earth connection in poor or little soil conditions

☐ Following the PolyRod startup procedures which requires one quart of water poured into the funnel section, earth resistance typically lowers by 50% in as little as 10 minutes, as measured by the three stake fall of potential method

☐ Conductivity change continues to improve with time as natural precipitation is collected or water is added to the PolyRod. The saline solution is percolated through the soil, increasing the volume of the salted ground, thus lowering the resistance to earth

☐ PolyRods come ready to use with 10 pounds of $MgSO_4$ salt

☐ Salts are visible through strip on UV stable plastic container (Salts must be in the ground to do any good)

☐ Container painted veggie green or desert tan

☐ The more salts dissolved into the soil the less water needed to obtain a low resistance/impedance earthing system

☐ PolyRod may also be interconnected to a drip water supply for timed water supplements during dry weather conditions

☐ Can be used indoors with a drip system and does not rely on humidity to work like other chemical rods

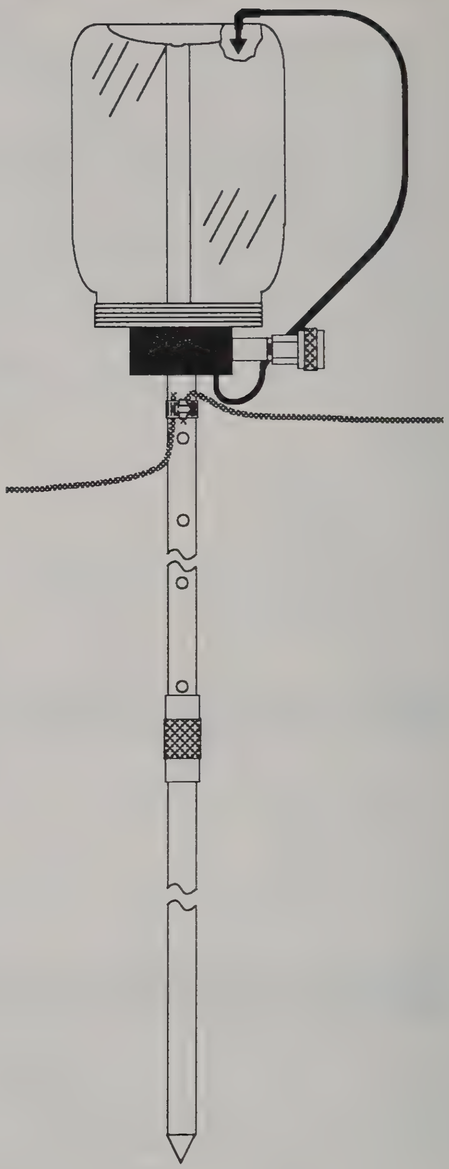
☐ PolyRod collects natural precipitation in its top funnel area

☐ Unlike other chemical rods, the PolyRod may be hammered in place for optimal soil compaction/conductivity for added speed in lowering resistance

☐ PolyRod comes with removeable pounding cap and hardened screw-in tip

☐ PolyRods can be exothermic welded or used with copper strap (see page 45)

— continued on next page

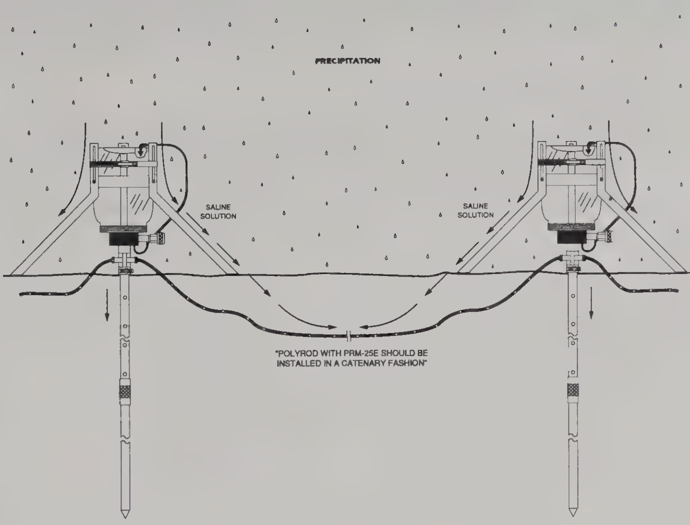


Order:

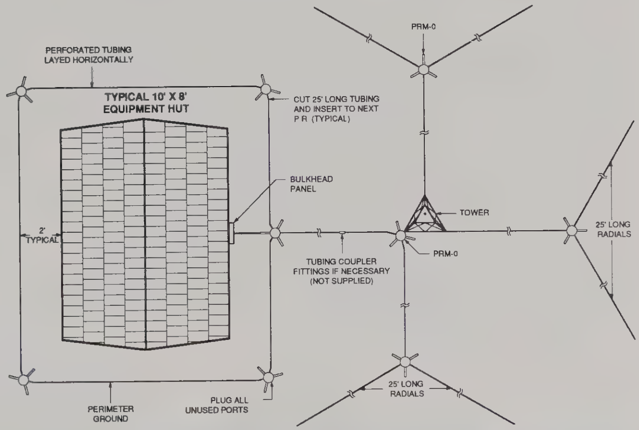
PR-4*	for up to 4 feet of soil (4' length)
PR-8*	for up to 8 feet of soil (8' length)
PRM-25E	for radial interconnecting adaptor kit
PRM-0*	for little or no soil (stand and PRM-25E)
PR	for 10 pounds of recharge salts

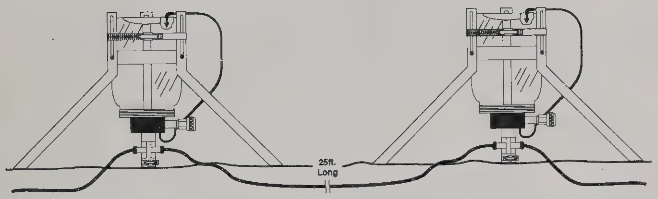
*Add suffix: T for tan
G for green (i.e. PR-4T etc...)

- ❑ The PRM-25E consists of a dispersion adaptor, three 25 foot 3/8" perforated lengths of copper tubing which can electrically interconnect PolyRods together as well as launch saline electrolyte to further reduce resistance and inductance
- ❑ They can also be used as radials and come with caps to plug the radial tube ends
- ❑ Using PRM-25E(s) together with PolyRods, one has the flexibility to configure an entire and complete grounding system
- ❑ For little to no soil sites, the PRM-0 is a combination of the PolyRod (with no rod section) and the PRM-25E radials
- ❑ An aluminum stand with adjustable legs holds the container section upright


PRECIPITATION
SALINE SOLUTION
SALINE SOLUTION
"POLYROD WITH PRM-25E SHOULD BE INSTALLED IN A CATENARY FASHION"

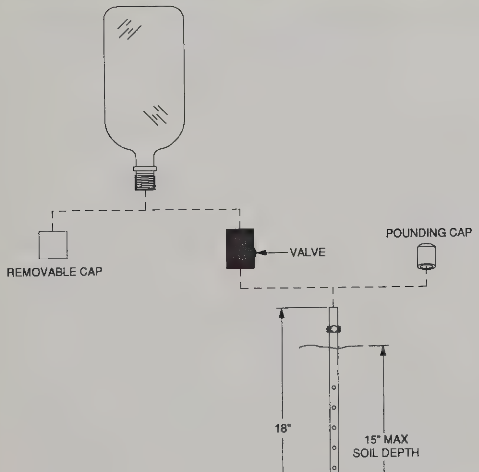
TYPICAL SITE LAYOUT


PRM-0
PERFORATED TUBING LAYED HORIZONTALLY
TYPICAL 10' X 8' EQUIPMENT HUT
CUT 25' LONG TUBING AND INSERT TO NEXT P R (TYPICAL)
BULKHEAD PANEL
TOWER
2' TYPICAL
25' LONG RADIALS
TUBING COUPLER FITTINGS IF NECESSARY (NOT SUPPLIED)
PRM-0
25' LONG RADIALS
PERIMETER GROUND
PLUG ALL UNUSED PORTS



PRM-0

ACTIVE SALT TACTICAL DEPLOYABLE GROUND ROD



- ❑ Quick reduction in ground resistance (<5 minutes)
- ❑ Quick installation (<10 minutes)
- ❑ Does not depend on precipitation
- ❑ Saline solution - low freezing point
- ❑ Tested in Nevada desert (315 ohms to 55 ohms/rod/2 minutes)
- ❑ Minimal soil depth needed (15 inches)
- ❑ Approximately 20 TDGR needed for a <5 ohm ground system
- ❑ Usable for lightning/EMP or for HF antenna counterpoise
- ❑ Additional saline solution containers can be used for >1 week installations

OPTIONS AVAILABLE: May be shipped without water content of saline solution (i.e. salt only)

Order: **TDGR** for Tactical Deployable Ground Rod

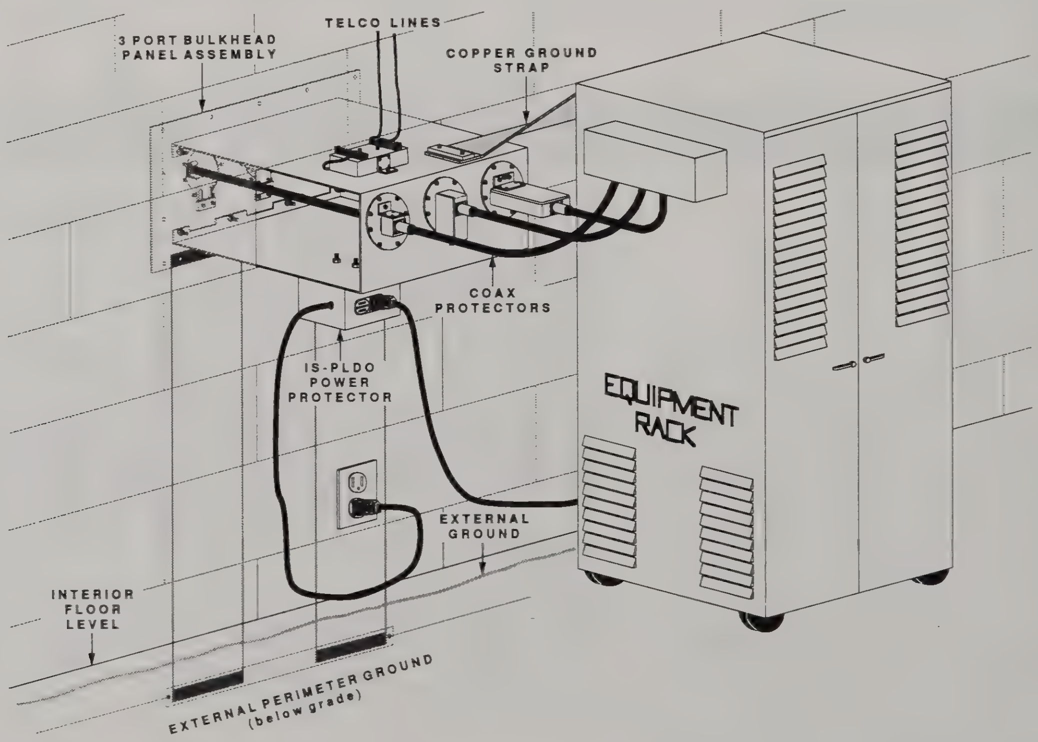
GROUNDED BULKHEAD ENTRANCE PANELS

APPLICATION:

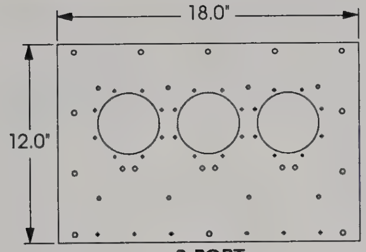
Where coaxial cables enter a facility and both grounding of the outside shield and coaxial protectors are desired to protect electronic equipment as well as for establishing a central single point ground location.

☐ Easy installation
☐ Handles up to 3 1/8" rigid line (without EIA flange) and up to EW28 type elliptical line (without flange)
☐ Provides grounding as well as watertight penetration
☐ No need for individual grounding kits and boots
☐ Boot covered finger grounds and supports line
☐ 6" wide 15' long copper straps provide low inductance, high surface area and have a sandwich bar connection with joint compound for a below grade lug or exothermic interconnection to your perimeter ground cable
☐ Removeable universal pre-punched protector mounting plates on U panel allow for easy installation and for rigid or elliptical line penetrations. Special mounting plates available for special protector configurations
☐ Boot made of EPDM +300, -60°F, excellent UV and atmospheric stability
☐ Made of special hardness copper so strong threaded holes can provide extra surface area interconnections
☐ All 18-8 stainless steel hardware and 300 series all stainless clamps
☐ U panel allows for indoor access only to the coax connections for a safe, dry and reliable installation
☐ U panel provides a low inductance grounding means for the coaxial protectors and can be used as a central single point ground for the entire facility

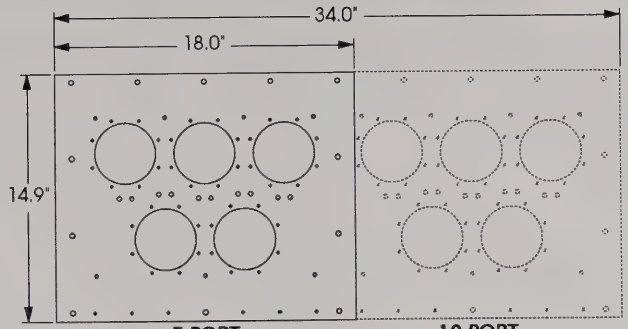
Order:	**3PB**	fits into single concrete block	
	5PB	2- 6" straps	
	8PB	2- 6" straps	
	10PB	4- 6" straps	two 5PBs
	16PB	4- 6" straps	two 8PBs
	24PB	6- 6" straps	three 8PBs



GROUNDED BULKHEAD ENTRANCE PANELS

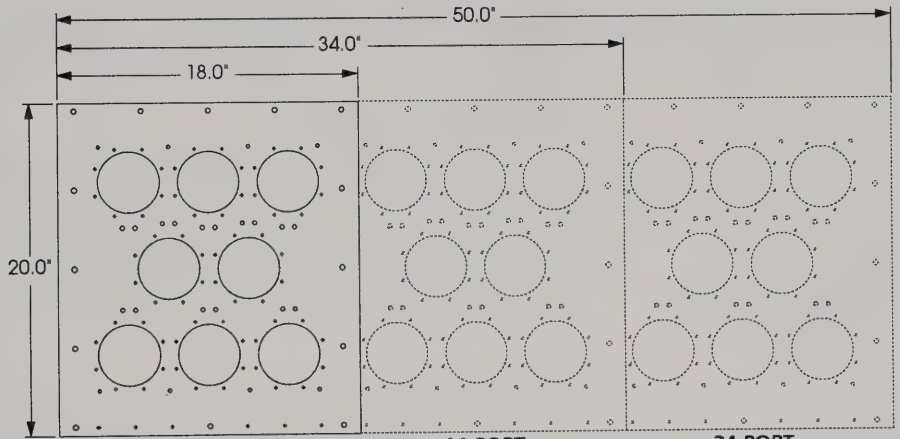


3 PORT
WALL HOLE SIZE
for U-PANEL
14.375"wide x 8.0"high



5 PORT
WALL HOLE SIZE
for U-PANEL
14.375"wide x 10.9"high

10 PORT
WALL HOLE SIZE
for 2 U-PANELS
30.375"wide x 10.9"high

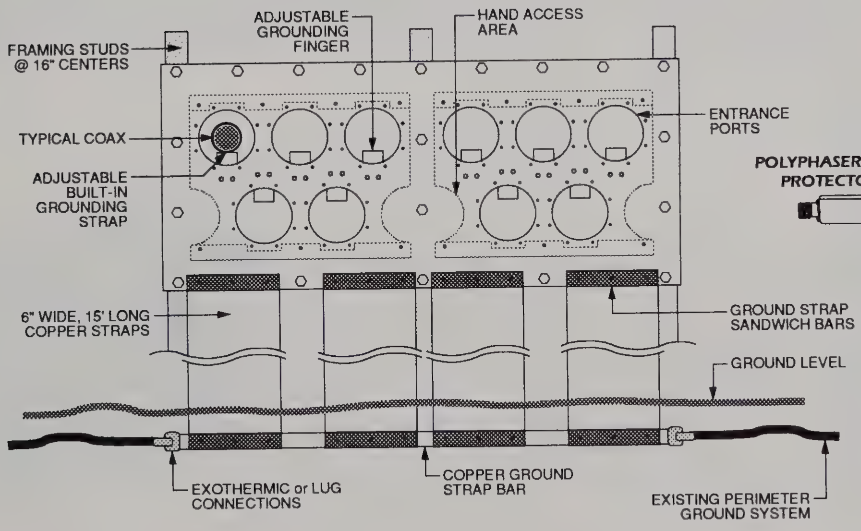


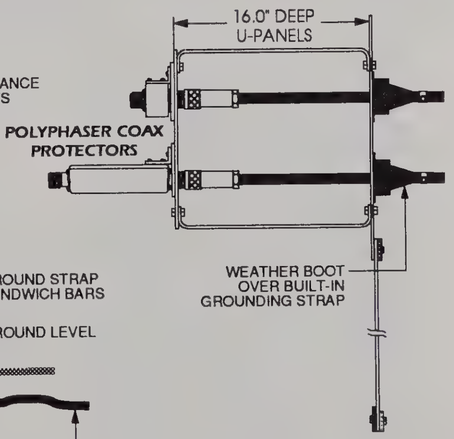
8 PORT
WALL HOLE SIZE
for U-PANEL
14.375"wide x 16.0"high

16 PORT
WALL HOLE SIZE
for 2 U-PANELS
30.375"wide x 16.0"high

24 PORT
WALL HOLE SIZE
for 3 U-PANELS
46.375"wide x 16.0"high

TYPICAL INSTALLATION


FRAMING STUDS @ 16" CENTERS
ADJUSTABLE GROUNDING FINGER
HAND ACCESS AREA
TYPICAL COAX
ENTRANCE PORTS
ADJUSTABLE BUILT-IN GROUNDING STRAP
6" WIDE, 15' LONG COPPER STRAPS
GROUND STRAP SANDWICH BARS
GROUND LEVEL
EXOTHERMIC or LUG CONNECTIONS
COPPER GROUND STRAP BAR
EXISTING PERIMETER GROUND SYSTEM

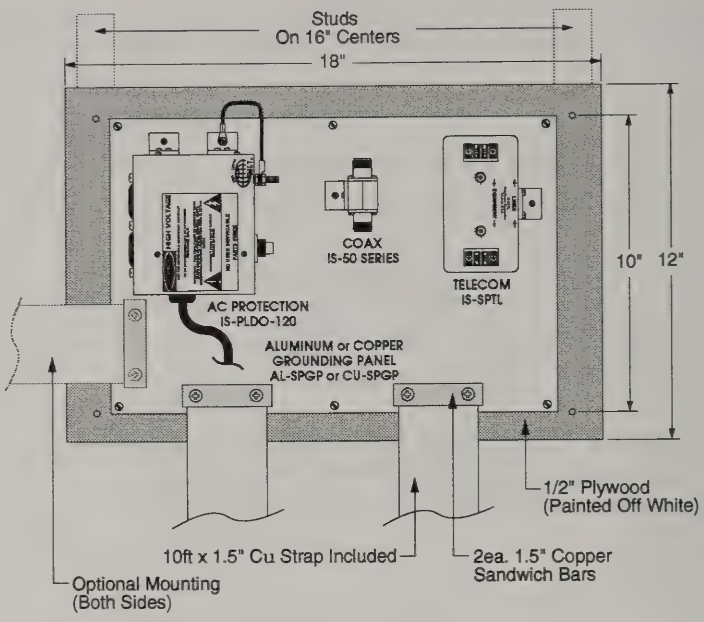

16.0" DEEP U-PANELS
POLYPHASER COAX PROTECTORS
WEATHER BOOT OVER BUILT-IN GROUNDING STRAP

NEW COPPER AND ALUMINUM GROUNDING PANELS

APPLICATION:

Where a grounded bulkhead entrance panel cannot be installed due to ownership, etc. and it is desired to provide proper and effective protection to a small group or rack(s) of equipment, this panel may be used to mount/ground protectors and to establish a single point grounding location for grounding the racks/chassis of equipment.

- ☐ Simple to install
- ☐ Fits 16" on center stud construction
- ☐ Comes with 4 lead molly anchors for concrete
- ☐ Aluminum or copper plate .062"
- ☐ Painted off-white 1/2" plywood backing
- ☐ 10 product mounting screws
- ☐ 10 feet of 1-1/2" copper grounding strap
- ☐ Two brass sandwich plates for the strap
- ☐ Joint compound



Also see installation drawing on page 12.

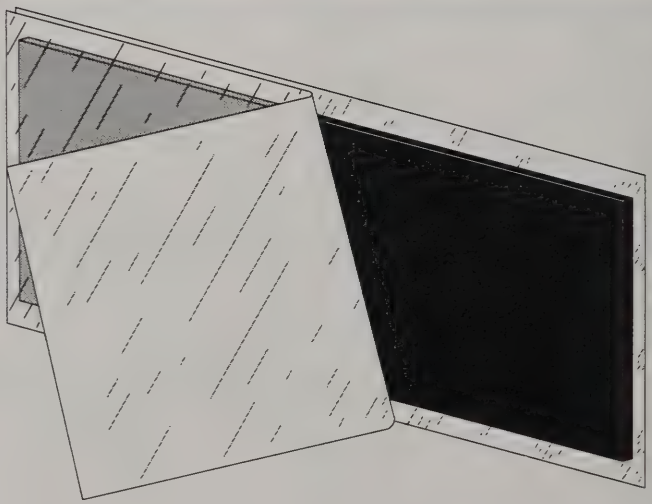
Order: **AL-SPGP** for Aluminum Single Point Ground Panel
CU-SPGP for Copper Single Point Ground Panel

NEW WEATHER PROOFING KIT MATERIAL

APPLICATION:

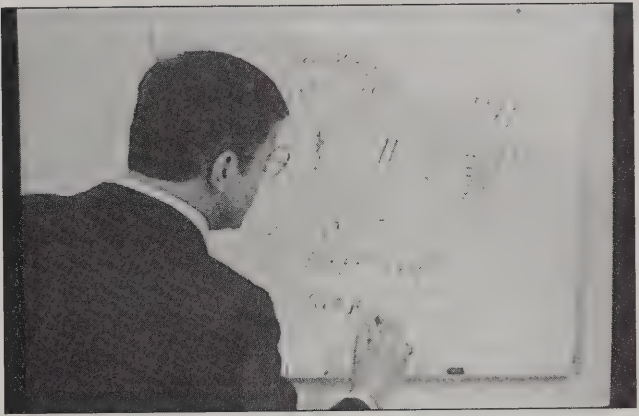
Where a weather tight seal is needed with an extreme temperature range and exposed to UV.

- ☐ Non-conductive
- ☐ Reusable
- ☐ Withstands -65°F to 180°F without cracking
- ☐ Paintable - latex or solvent based paints
- ☐ Water impermeable (Mil-S-19653A)
- ☐ Exceptional UV and salt spray resistance
- ☐ Non-irritation to skin
- ☐ Black - self adhering
- ☐ Hand applied
- ☐ Measures 2.5" by 6" by 1/8"



Order: WK-1

GROUNDING VIDEO TAPES



APPLICATION:

Hour long overview of grounding covers types of lightning, why the damage, grounding, materials, measuring, protectors, types of grounding, placement of protectors and tying it all together.

- ☐ One hour w/charts, graphs, pictures and drawings
- ☐ An Overview- with other more site specific videos to follow
- ☐ Available in VHS: NTSC, PAL, N PAL, M PAL, SECAM, and MESECAM, TV formats

Order: **Grounding - An Overview**
Note: export orders - please give TV format desired

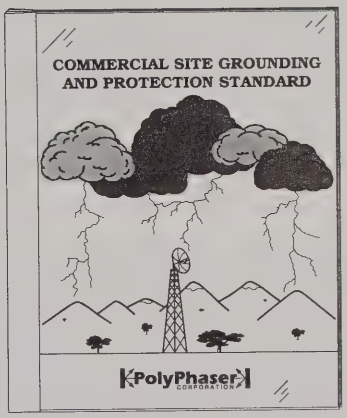
COMMERCIAL SITE GROUNDING AND PROTECTION BOOKLET

APPLICATION:

This 16-page standard is set up like a Mil standard. It covers grounding installation, materials, protectors, from good earth conductivity to mountain tops, and high rise sites. Introducing the AGE (Automatic Grounding Equipment) concept, it also gives tutorial information. (No drawings).

To order the
Site Grounding Standard
booklet

Order: **SGS**

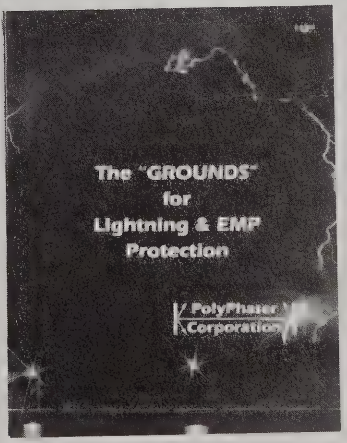


THE “GROUNDS” FOR LIGHTNING & EMP PROTECTION

APPLICATION:

This often cited book is presently in for its second printing. Some new material is being added with some updates and clarifications. New drawings will help illustrate the concepts in this 100+ page comprehensive analysis of proper grounding/protection for lightning/nuclear EMP applicable to all types of communications equipment. Simple math (one formula) with a lot of easy-to-follow explanations of how to and why, that make sense. Radio towers, telephone, power, LAN, TVRO, security cameras are just a few of the other topics detailed.

Order: **GLEP**



GROUNDING OVERVIEW

Lightning strikes, like people, come in all different shapes and sizes. It is a statistical event like dice which means that a typical "7" type of lightning can be characterized, but a "2" or "12" can still occur. An economically designed protection/grounding (P/G) system should take into account a typical-to-large strike. One can not put too much money into a P/G system. Money should also be allocated for the maintenance, both routine and preventative, of the P/G system on a monthly or at least yearly basis. This should include testing protectors, measuring your ground system, pulling on ground rods, and cleaning/inspecting connections for corrosion and tightness. It should also involve a re-thinking of the overall system design each time new equipment is installed, moved, or modified.

In a P/G system design one should also think of system noise reduction and EMI/RFI (Tempest) shielding. This can and often is accomplished via a single point grounding system. Sometimes the use of a single ground bus (called the Principal Ground Window) (PGW) can act as your single point. All your equipment chassis should be grounded to this bus. Often it can and should be a large surface area connection to the ground system such as via a bulkhead panel system.

Noise reduction can also occur through the use of shielded signal cables that are only grounded on one end. This acts as a Faraday shield. A halo ground system with multiple down conductors to the outside ground system can act as a quasi-Faraday cage and give some low frequency shielding. Properly bonded metal building panels can act as a more effective cage. Double walled screen rooms are the ultimate in shielding. The plasma column of the lightning strike (return stroke) can have a rise time of a microsecond or so, typically. If it hits a tower, the tower will handle the majority of the current to ground. The tower will also radiate the RF energy of the strike. The near field (high magnetic or H field) will be cut by equipment interconnecting wires and induce surge energy. A Faraday cage can reduce this energy as well as adding distance between the tower and the equipment hut.

DISSIPATION BRUSHES

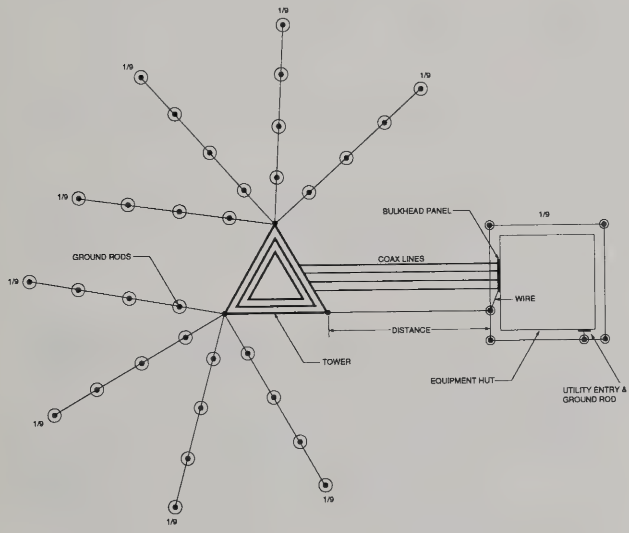
Whether due to a mountain, building or just tower height, the strike frequency goes up as the square of the height over average terrain. Nothing can be done to totally prevent a strike. Making a tower's top more blunt may help so long as no sharp points are present. Whisker brushes and static dissipation gismos will not prevent or even lessen the occurrence of a strike and may even increase its probability. Ions created due to a point or points in the high E fields of a charged cloud will be wind blown and will drift upwards. These ions increase the conductivity of the air and effectively increases the height of the grounded object (tower etc.) thus increasing the frequency of strikes.

The manufacturers of such gismos point out a decrease of electrostatically induced potential in the ground system; this can not happen unless the ground system is almost non-existent (very high resistance). If we were to isolate the entire site from earth, it would have a specific surface area and thus the ability to hold a charge (capacitance). The time to charge the site is the time constant of ground resistance times capacitance. The discharge of the site is the array current divided into the E field from the cloud. Typically this is about 10 μA for a single point to as much as 0.5 amps for a large system in a 10kV/m E field. A large system would represent a 20k ohm load (10kV/.5A = 20kΩ). A 20k ohm ground system (to keep the net gain to zero) would indeed be very poor. Typically a ground system should be 5 ohms or less which means that the earth can supply the electrostatically induced charge 4,000 times (20k/5 = 4k) faster than what is dissipated by the points.

There is no "isolation" of a ground system as some array gismo sales literature may lead you to believe. By definition, a 5 ohm ground system is 5 ohms to no matter where else on the globe.

A lightning strike starts with a local breakdown of the atmosphere (step leader) and steps about 150 feet in 1 μs time increments every 49 μs. During each of the 49 μs dormant stages, an imaginary hemisphere of 150' radius can be used to determine the next jumping distance. Any object (such as a tower or even a dissipation gismo) which penetrates this hemisphere, can be chosen as the point of attachment for the return stroke (lightning strike). Since this is a hemisphere, the geometry can be such that a horizontal strike to a tower can occur anywhere above the 150' point over average terrain (so side mounted antennas above this height are just as vulnerable). This has led to the 150' radius rolling ball concept whereby an imaginary ball is rolled along the ground in all directions. Each touch point of the ball with any ground mounted object is subject to an attachment point (hit). From this the need for coax grounding kits at the 150' point and every 100 feet or less above the height, of course, one at the bottom and one prior to the hut entry should be obvious.

Lightning will take the path of least impedance which is both resistance and inductance. Since every conductor has inductance, it is a matter of surface area (skin effect). The larger the conductive surface, the lower the inductance. Bends add inductance - a coil is the continuous bending of a wire. Ground wires should be large and run straight for minimum inductance and voltage drop. They also should be separated from all other conductors by 6" to 8" and should not be run inside or through a conductor unless it is bonded to it. For conduit, bond at entrance and exit. For metal walls - bond to it on both sides, never go through it.



Your tower will be the point of impact like a pebble going into a still pond. The rings will be equipotential waves as they diffuse into the surrounding soil. The ground wires in the soil still have inductance. This inductance together with the soil resistance sets up a time constant or velocity of propagation (since capacitance is present also). So the ripples will propagate faster with larger surface area wire and better conductive soil. The doping of soil with $MgSO_4$ and $CuSO_4$ salts will help increase soil conductivity and help retain water.

The soil is conductive due to the natural occurring salts and moisture content. It is not prudent to run interconnecting rings around a tower. Self support towers will pretty much equalize the surge current to each leg (the coax leg may have slightly more current). Guyed towers should not have rings, even if the rings are to act as a collector for the radials. If each radial is interconnected directly to the tower base or leg, the inductance would be less than having only one or two connections going to a ground ring. Rings further out would be connecting radial ground rods that will be at the same potential at the same point in time, thus little current will flow as compared to taking the same material and effort and running another radial from the tower base.

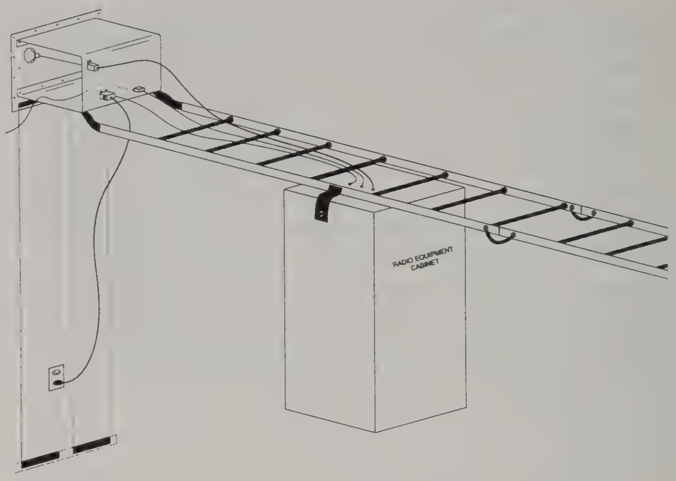
Guy anchors should be grounded with no dissimilar metals (see our book "The 'Grounds' for Lightning and EMP Protection", Page 26). In poor soil conditions, radials can be used together with ground rods to ground the anchors. A ground system can be obtained in many ways but the most economical is via radials and ground rods. Radials of less than 100 feet will disperse the tower base or guy wire energy outward while the ground rods can help take it to lower, more conductive soil layers. If the surge is not leaked or launched into the soil in the radial section(s), the ground rods, if no better lower soil conductivity is to be had, will develop a high E field at it's end and can arc in the soil to spread the charge outward. (This arcing is less likely in higher conductive soils.) It can cause glassification around the rod, starting at the tip and working upward. The hot plasma fuses the silica sand into a glass which is a good insulator since water is boiled out in the process and can no longer re-penetrate the hardened glass. This is why, as a routine maintenance, a tug on the rod can indicate easy movement, a possible indication of glassification.

Unlike the radials, ground rod diameter size will have little effect on impedance unless the rod is very long. It is not always imperative to reach the water table since this may be too far for the rod to be effective. It may be easier to salt dope the rod or to use a chemical ground rod with replaceable salts that collect precipitation. In poor soil conditions, the spacing of ground rods should be closer together since the radial will lose less energy per linear distance. Another way of looking at it is the ground will not shunt the radial's inductance, thus more ground rods will help by either reaching more conductive soil or arcing to relieve the voltage potential. Otherwise the voltage will build up at the tower and attempt to go another, perhaps unwanted, path. The whole practice of lightning protection is to control the discharge path and not have it randomly disperse in any direction. In normally conductive soil, the rods should be spaced the sum of their distance in the soil, apart. No one long deep rod or well casing will be as effective as an array of radials and ground rods even if the one deep rod measures a low resistance; the inductance is usually much greater and thus is a higher impedance path. Even in conductive upper layer soil conditions, soil saturation can occur which can cause eddy currents and additional inductance.

All radials should be run away from the equipment hut. The more radials you have, the more the current is divided. A perimeter ground system (ring) around the hut will help form an equipotential plane. If this ring is approximately equal (in length) to each radial and say 8 radials are used, each will have 1/9 the total surge energy leaving only 1/9 the strike energy for the equipment hut perimeter ground. The less the energy to the hut ground, the better. The perimeter should only have one interconnection to the tower base and should be just below the coax cable runs. For mountain tops, where no conductive soil exists only radials can be used, wide copper strap, 1" to 3" wide, should be used to minimize inductance. For all sites, the re-bar in the concrete should be used to augment your grounding system. Concrete is conductive because of retained moisture and alkalinity. Many people not knowledgeable on how to use the concrete, shy away from it with old tales of blowing up your concrete. This will not happen. Look at it this way. J bolts or anchor bolts are already embedded into your concrete. If your ground system is not adequate, the current density (J) will be high enough to cause arcing at the bolts. If you were to interconnect the rebar the current density would be reduced and have a less likely chance of arcing to occur. To learn more on designing with the rebar see our book "The 'Grounds' for Lightning & EMP Protection".

Ground wires run up a metal tower are a waste of time. The difference in resistance between copper and galvanized steel is lost in the difference in inductance due to surface area (skin effect). Many try to place a lightning rod at the tower top and use the copper cable to run it down to ground. The inductive voltage drop of the wire (>100kV) will cause it to jump (arc) to the tower anyway unless it is stood off about 24" from the tower. In fact the use of bare copper cable can cause a corrosion problem to the tower and should not be used unless covered. Copper should never come in contact with galvanized steel. Likewise tinned copper wire should not be used in the ground together with copper ground rods since the tinning will be leached into the soil in short order.

Try to design some space or distance between the tower and the coax cable entry. This distance will give additional propagational time for the ground to absorb the strike energy. At the building entry bulkhead panel, coax protectors should be used in addition to another set of coax grounding kits. This bulkhead panel should have as large a surface area connecting it to the perimeter ground as the combined surface areas of the coax cables. Tower lighting protectors should also be included and grounded at this same point.



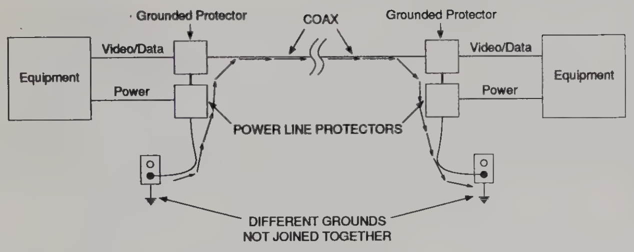
Tower flasher lines, both strobe and conventional, should have protectors to prevent surge entry into the hut on the power lines as well as nuisance damage to strobe P.C. boards.

In order to ensure survival of the hut equipment, all Inputs/Outputs (I/O's) must have protection and they should all be ideally located at the principal ground window or bulkhead panel. If these I/O's (power telco, etc.) enter elsewhere, protect them first at the entry point (ground protector to perimeter) run to Perimeter Ground Window (PGW) and protect it again before distribution via the cable trays. (Note all trays should be grounded to the PGW or bulkhead panel).

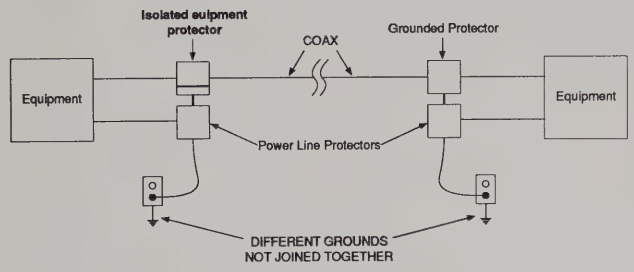
TYPE OF PROTECTORS

The best type of protector is an in-line type because it can better clamp and protect while preventing the sharing of surge voltage and current with your equipment. For telco lines one needs the best protector when just a few lines are used. This is because every ground system will momentarily saturate or elevate with respect to the surrounding area, at least until the surge can propagate and dissipate into the soil. This means that your site ground system will force "on" protectors (power and telco) and dump surge energy onto these outbound lines. Thus the greater the number of lines (telco) you have, the more the surge is divided as it is distributed over these pairs. Vice versa, the single pair needs the world's best protector to ensure equipment survivability from overvoltage stress as larger surge energy is diverted to this single outbound pair.

GROUND LOOP = HUM



GROUND LOOP ELIMINATED by using PolyPhaser's IS-IE series protector, available in 50,75 and 93 ohms



LOCAL AREA NETWORKS

Where fiber is not used, coax or twisted pairs can provide LAN or WAN systems. One major problem often seen is an application between buildings where different local grounds are used. This can cause protectors which protect in differential mode (wire to wire) as well as common mode (wire to ground) to see a voltage over the turn-on threshold between wires and grounds and thus clip, induce a hum, or not allow the system to operate. This is not the fault of the protector but the system design. Grounds should be in common or special protectors (IS-IE50, 75 or 93 series) used to overcome such design problems.

POWER LINE

Lightning and surge protectors are no substitute for an Uninterruptible Power Supply (UPS). However many UPS do not have any or adequate surge protection. Inline protectors can offer filtering of the line; however, don't go overboard on filtering since many protectors use ferrite core material which will saturate on major surges and be useless. Look for only air core type inductors (PolyPhaser uses only air core inductors). They may not offer as low a cut off frequency or as much filter attenuation and are physically larger, but they will not change with surge current or become less effective due to ferrite core magnetic orientation as ferrite core coils will. Noise has never been known to damage equipment circuitry and it takes a lot of noise to couple through to upset a well designed circuit. If your equipment is sensitive and critical, it should be on an UPS which will buffer any line noise from your system since the ac power is re-generated. (Remember filters do not absorb or dissipate energy but merely shunt or reflect it back to its source).

Power line protectors that cover the wall outlet when they plug-in are only good for stand-alone equipment with no other I/O's. This is because other I/O's can input a surge to the equipment and now the power line protector, which is far away on the end of an inductive cord, will be useless in containing the overvoltage and protecting the power supply. Protectors should be in common with (via a short interconnection) the chassis of the equipment that is to be protected and not at the end of a long equipment power cord. This may be hard or impossible to do with consumer type protectors in decorator colored plastic enclosures but not with PolyPhaser's brushed aluminum case. It may not be as pretty as others but Lightning protection is no beauty pageant. It isn't a consumer toy but an industrial strength protector.

This is just an overview of proper grounding and protector installation. For a more in-depth look at the why's and wherefore's our 116-page book "The 'Grounds' for Lightning and EMP Protection" will provide such a view and is available in this catalog.

We have been asked many times after a lightning strike how to determine whether a unit, which has protected your equipment, will work again. The F.I.S.T.-4 unit is the best way to test a unit and measure its useful life. However, the end of life mode of almost all units is a "short" mode.

Semiconductors, whether silicon based or Metal Oxide Varistors, (MOV) will die in a shorted mode when at the end of life or when over powered beyond its designed capabilities. However, if subjected to power levels in excess of the fusing levels of the wire leads, the unit may fuse open.

Likewise, gas tubes will die in a shorted mode unless subjected to massive power levels which can explode the gas tube and vent the sub-atmospheric gases, in which case it becomes an open circuit. Lab test levels show that our IS-NEMP, IS-B50 and IS-50 series models will vent the gas tubes at 89 kA and above using the IEEE 8/20 waveform. This is 89 kA on the center conductor relative to the shield which equates to over 200 kA strike levels on the total coax line alone. (See page 4). If a steel tower structure is present and grounded, further current sharing will take place as described in chapter one of our tutorial book "The 'Grounds' for Lightning & EMP Protection". This will boost the necessary strike level for gas tube destruction to the very limits that nature can dole out. The cumulative effects of repeated strikes can be measured by our Lightning Strike Counter (LSC) but statistically each strike is somewhat different with different energy levels. The LSC units can only give a rough idea as to the useful life left in any given Impulse Suppressor.

We are working on an "Energy Counter" that can give better results but until then we recommend that an annual spring test with our F.I.S.T.-4 unit will give confidence that your Impulse Suppressors are on the job and ready to protect your equipment. The F.I.S.T.-4 unit comes with an Instruction Book that gives high and low extremes for testing all PolyPhaser models.

Please feel free to contact the factory for a Return Authorization Number if you would like us to inspect/test your Impulse Suppressors.

TESTING AND SPECIALS

Testing can be done on any product. Please indicate the type of testing that you need and contact us. Testing results to mil specs such as Mil-STD-462 or equal can be obtained in writing only. Some results we may consider proprietary and will not be released without the need to know. Specials done for customers can be sold to others unless we are notified in writing. All other specials will be at our discretion as to saleability to foreign governments.

Appendix B

MULTI-CHANNEL COMBINING

Combining is summing multiple channels together to feed onto a common cable. Low frequencies and higher frequencies will in time reach a peak voltage together of the same polarity. This voltage summation peak can have more peak power than the sum of their RMS powers. Since the protectors are voltage sensitive, they must be designed to handle combiner outputs or turn-on on RF voltage peaks can result. This can cause major problems at other frequencies (intermod, spurs, interference, etc.). Each protector designed for combiners is listed as to its total voltage peak (V_T) that it can handle without RF turn-on. This total is the summation of all the voltage peaks for each channel being combined.

$$V_T = V_{P1} + V_{P2} + V_{P3} \cdots + V_{Pn}$$

where $V_P = 1.414 \cdot X \cdot \sqrt{P_{ch} \cdot 50}$

P_{ch} = channel power out of combiner

and for a

VSWR	X =
1.1 to 1	1.05
1.2 to 1	1.09
1.3 to 1	1.13
1.4 to 1	1.17
1.5 to 1	1.2
1.86 to 1	1.3

Appendix C

TO CALCULATE THE INDUCTANCE OF A WIRE USE:

$$L(\text{in } \mu\text{H}) = 0.508l\,[2.303 \log_{10} (4\,l/d) - 0.75] \times 10^{-2}$$

TO CALCULATE THE INDUCTANCE OF STRAP USE:

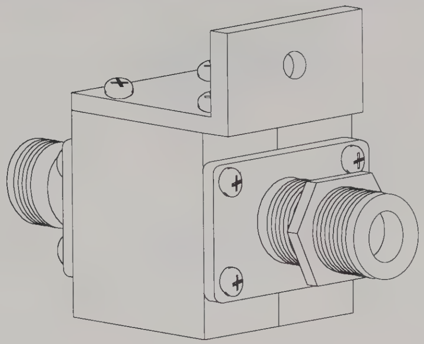
$$L(\text{in } \mu\text{H}) = 0.508l\,[2.303 \log_{10} (2\,l/(w + t)) + 0.5 + 0.2235\,(w + t)/l] \times 10^{-2}$$

Where l = length in inches
d = diameter in inches
w = width in inches
t = thickness in inches

BROADBAND HF/VHF/UHF BULKHEAD COAXIAL PROTECTORS

UHF CONNECTORS

- IS-B50LU-CO
- IS-B50HU-CO
- IS-B50LU-C1
- IS-B50HU-C1



Model Shown
IS-B50LN-C2

'N' CONNECTORS

- IS-B50LN-CO
- IS-B50HN-CO
- IS-B50LN-C1
- IS-B50HN-C1
- IS-B50LN-C2
- IS-B50HN-C2

True Bulkhead Grounding, Shielding, and Weather Tight Penetration

New threaded UHF and 'N' connectors work with up to 1/4" thick panels providing both weather tightness and a good electrical connection to handle grounding the shield for the worst lightning strike and for added shielding purposes.

High and Low Transmit Power Models Optimally Protects

These protectors come in both a high and low transmit power handling so that the best protection can be achieved for each application. VSWR ≤ 1.1 to 1 IL ≤ 0.1dB.

DC Blocked Design has Three Advantages

Patented DC blocking capacitor does three things: First, it insures that the unit will work to protect all types of equipment, unlike DC continuity devices that can't protect receivers or shunt fed cavities because of their own DC path to ground which prevents the gas tube from firing. Second, it acts as a high pass filter to attenuate the low frequency energy of the strike. Third, the leftover DC arcing voltage of the gas tube is prevented from reaching your equipment.

No Inductors to Saturate and Become Lossy

Other protector designs that use a ferrite core inductor will saturate with the DC content of a lightning strike. Once saturated, the ferrite's retentiveness will orient the core and RF losses will be incurred. The IS-B50 Series has no ferrite inductors which insures a long low loss life.

Limits Differential Strike Voltages

PolyPhaser's® design has the gas tube between the grounded aluminum enclosure and center conductor. This grounds the shield and limits the center conductor voltage relative to this grounding point.

Pressed-In Gas Tube Insures High Strike Current Capacity

By pressing the gas tube in place it gives a corrosion free joint that will not arc and carbonize over time and strike occurrences. It can handle multi-strikes to 50kA (ANSI C62.1 8/20 waveform) with 500 Joules of energy.

New Diver Tested Water Tight Low Power Models

A new water proofing design is now an available option. This design meets 6' drop tests and many MIL specs.

MIL Parts and Quality Tested

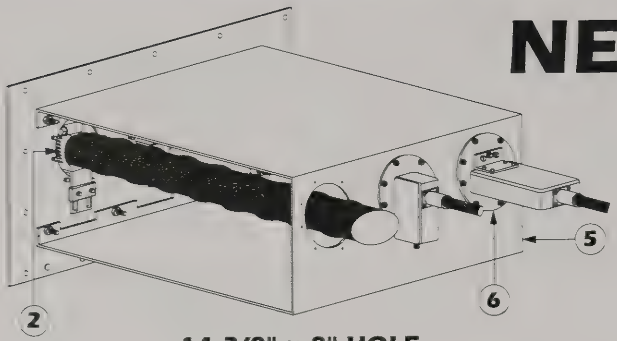
Uses MIL-C-39012 connectors; with 'N' type it meets QQ-C-530, having a silver shell (To QQ-S-365) with gold center (To MIL-G-45204) for low intermod generation and TFE insulator to L-P403; UHF connectors nickel shell, silver center and TFE. Built following MIL-STD-454J and uses Sn62 solder to QQ-S-571. All IS-B50 Series meets MIL-STD-202 107F Cond. B-65C to 125C. All are individually tuned and tested to MIL-I-45208A quality.

New 10 Year Warranty

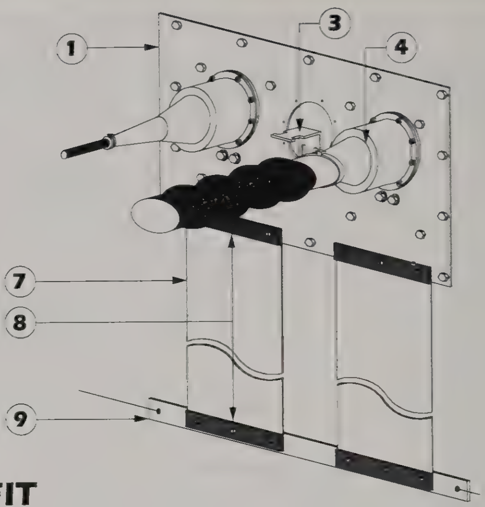
The best part is that we stand behind our products and provide an easy way to provide assistance. Just call, ask for a Return Authorization Number and return the unit in question. It's that simple.

BULKHEAD PANEL SERIES FOR ELIPTICAL AND RECTANGULAR WAVEGUIDE

NEW

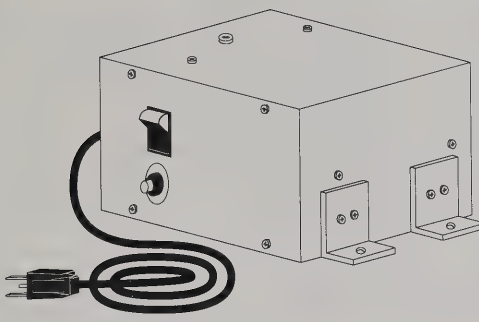


14 3/8" x 8" HOLE
3 PORT



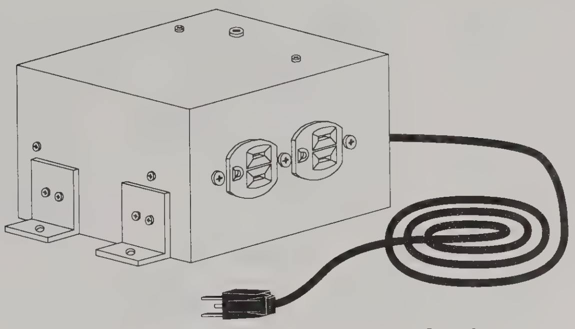
FEATURE	BENEFIT
1) Fully configurable -	Constructed out of 1/8" half-hard copper, they are available in a 3, 5, 8, 10, 16 and 24 port configuration (the 3 port unit will fit in the same area as a concrete block).
2) Clamping finger supports -	Grounding kits are built in. You can simply strip the outside jacket of your coax lines and clamp the adjustable finger supports into place using the included joint compound.
3) Adjustable copper finger -	One feed-thru boot fits all. The clamping finger support is fully adjustable, and can accommodate transmission line or wave guide from 1/2" to 3-1/8" in diameter.
4) Weatherized ports -	Each port is automatically weatherized thus eliminating the need to purchase extra close-off boots.
5) U-plate subpanel -	Extends through the wall, and inside the room to allow for easy inside only access to connect/disconnect from impulse suppressor.
6) Removable universal mounting pattern -	Furnishes an easy-to-use mount for any PolyPhaser® bulkhead coaxial protector or remove them to accept elliptical or rectangular wave guide.
7) 6" copper straps -	Two 15' long, 6" wide copper grounding straps provide an excellent, low inductive, extension to your perimeter ground system for 3, 5, and 8. The 10 and 16 port will have 4 and the 24 port will have 6 straps.
8) Sandwich bars -	6" wide, copper sandwich bars maintain excellent flush ground connections between copper materials. Joint compound is also included to weatherize sandwich joints.
9) In-ground connection bar -	Each panel is supplied with a in-ground 1" sandwich bar for connection to the perimeter ground system. You can also exothermically weld the bar to your perimter ground system.

MET APPROVED PLUG-IN AC POWER PROTECTOR



Rated @ 15 Amps

MODEL #
IS-PLDO-120



15 ft. Power Cord

Multi-Stage Surge Protection

Two stage protection, whereby the first stage handles the higher surge energy and the second stage will pick up any remaining energy and limits the surge voltage even further.

Handles a Typical Lightning Strike

Balanced and matched metal oxide varistors (MOV's) per stage with air coils and capacitors, insure that each unit will handle a 20kA 8/20 surge without exceeding 800 Volts at the equipment outlet (10kA ≤ 400 Volts).

Shielded Non-Flamable Enclosure

Aluminum housing insures a low inductance ground and allows for single point grounding. In addition, the aluminum housing provides shielding from both inside and outside the unit.

Non-Saturating Design

Provides EMI/RFI filtering and, because it's an air coil, it will not saturate under high surge energy and load current.

Quality Tested and Approved Product

PolyPhaser® surpasses industry standards. Every unit is tested and inspected per MIL-I-45208A. It is NRTL listed as a transient voltage surge suppressor (TVSS).

Safe Disconnect Protection

In the unlikely event of a disastrous surge, a specially tested circuit breaker will interrupt the power to prevent serious damage to your protector and equipment.

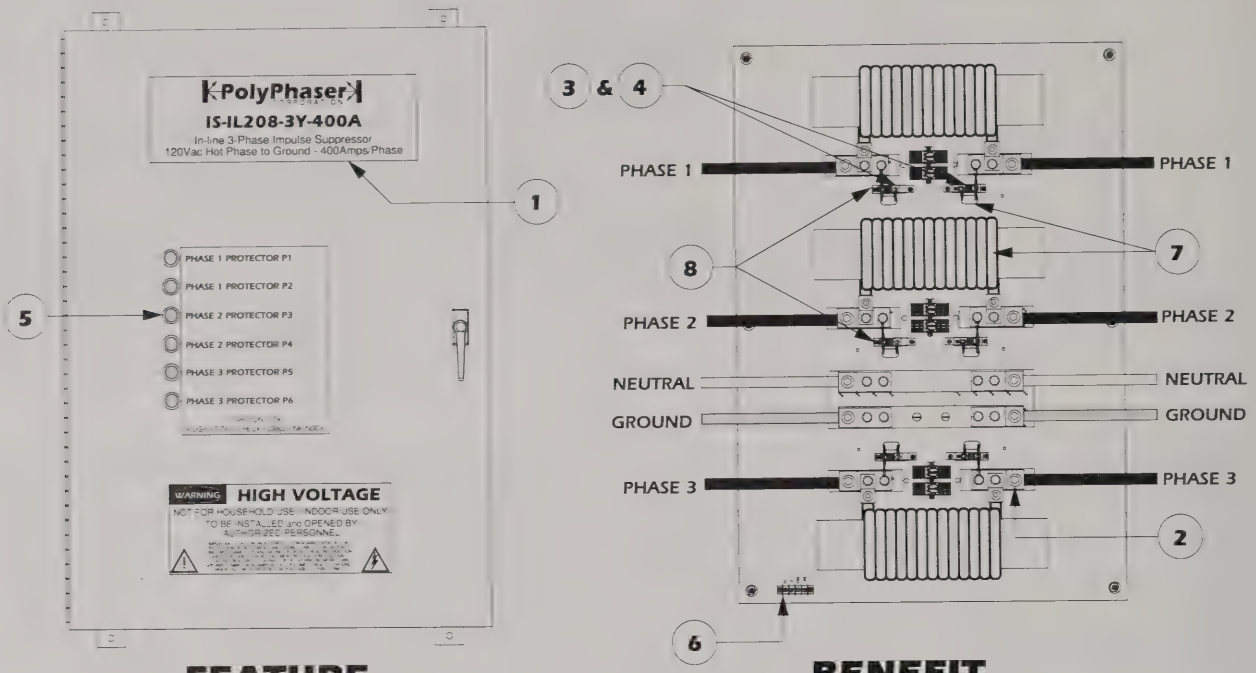
Internal Quality Construction

To insure high surge handling capabilities, every component is crimped and soldered with silver content solder to each terminal connection.

New 10 Year Warranty

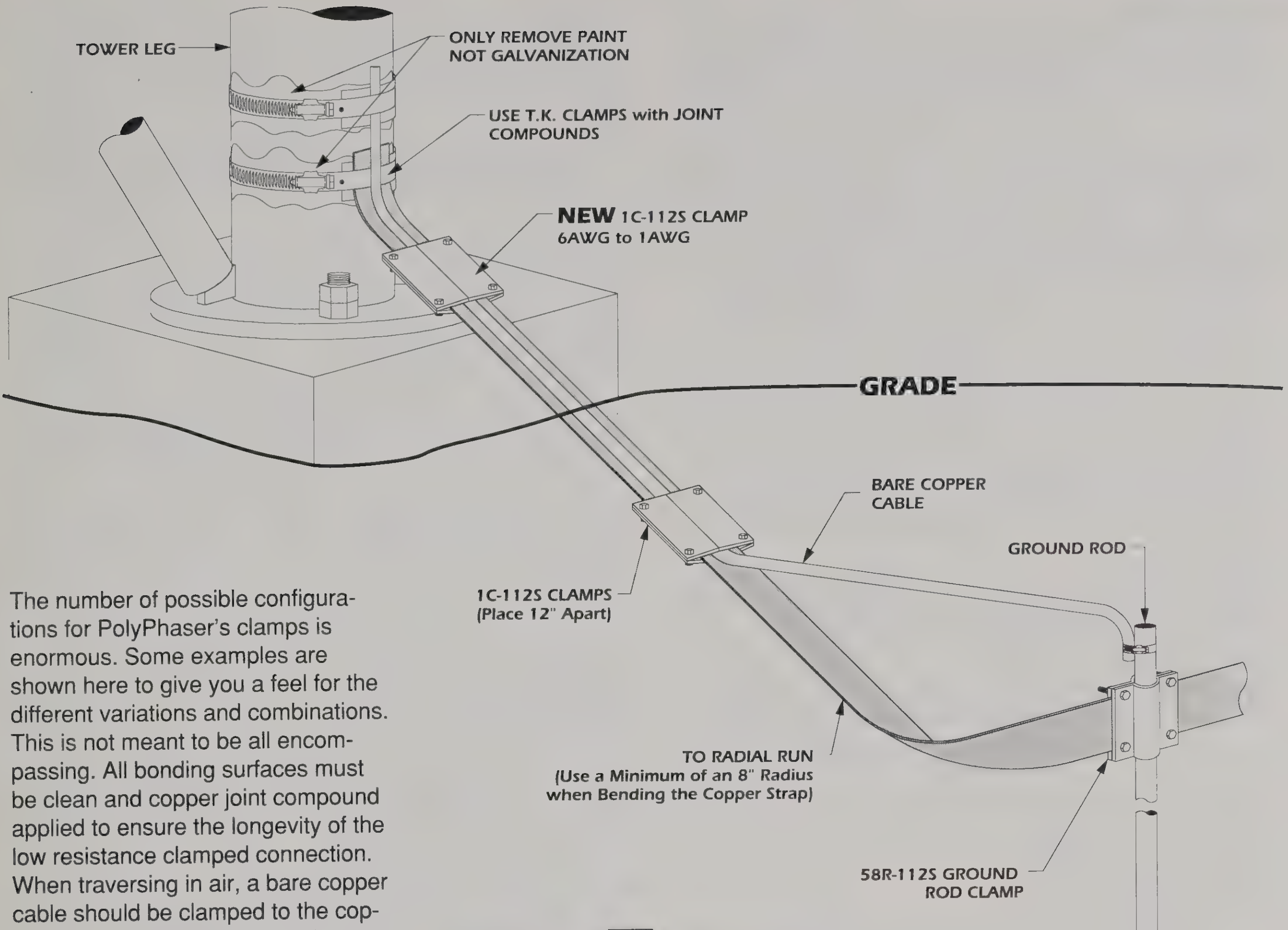
We stand behind our products. We don't need serial numbers, warranty cards, or sales receipts! If your unit does not perform as it's supposed to, simply call the factory for a return material authorization number. It's that easy.

IN-LINE POWER MAINS SERIES

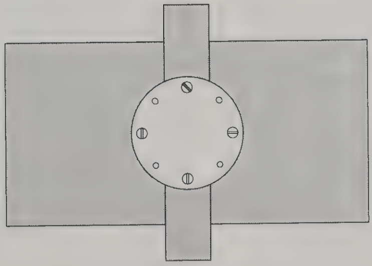


FEATURE	**BENEFIT**
① All Configurations of Power -	Available in multiple voltage configurations: (120, 240, 377 & 480Vac) Single, Bi or Three-phase power with 100, 200 or 400A current handling capabilities.
② No Power Loss Design -	Power will be uninterrupted even if a protection block should disengage by its series fusible link.
③ Multi-Stage Surge Protection -	The first stage will handle the higher surge energy, while the second stage will pick up any remaining energy.
④ Built-In Back-Up -	If one stage should breakdown, there is still an additional stage protecting your equipment.
⑤ Local Light Status -	Front panel lights indicate that the in-line power mains protector is functional.
⑥ Remote Alarm Status -	Dry 10A relay contacts allow you to monitor both power and protection status at your remote facilities.
⑦ Non-Saturable Design -	Air coils and capacitors provide adequate filtering and, because it's an air coil, it will not saturate under high surge energy.
⑧ Field Replaceable -	Simple effective design supplies excellent protection, yet you can field replace the protection components.
⑨ **10 Year Warranty -**	High quality UL components furnish multi-strike capabilities backed by our ten-year warranty.

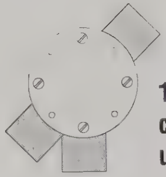
STRAP CLAMP CONFIGURATIONS


TOWER LEG
ONLY REMOVE PAINT NOT GALVANIZATION
USE T.K. CLAMPS with JOINT COMPOUNDS
NEW 1C-112S CLAMP 6AWG to 1AWG
GRADE
BARE COPPER CABLE
GROUND ROD
1C-112S CLAMPS (Place 12" Apart)
TO RADIAL RUN (Use a Minimum of an 8" Radius when Bending the Copper Strap)
58R-112S GROUND ROD CLAMP

The number of possible configurations for PolyPhaser's clamps is enormous. Some examples are shown here to give you a feel for the different variations and combinations. This is not meant to be all encompassing. All bonding surfaces must be clean and copper joint compound applied to ensure the longevity of the low resistance clamped connection. When traversing in air, a bare copper cable should be clamped to the copper strap. The clamps should be spaced no more than 12 inches apart. The cable will act as a wind vibration dampener and give added mechanical strength to the larger surfaced strap. For best dampening, light surface contact should be maintained between clamps, if possible.

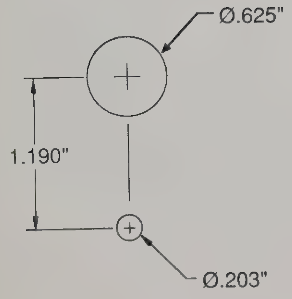


Typical 6" to 1-1/2" connection using MSC-3



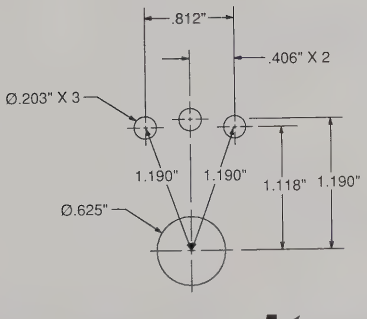
1-1/2" strap connection using MSC-3

BULKHEAD MOUNTING HOLES



STANDARD BULKHEAD MOUNTING HOLES FOR FEMALE CONNECTORS

(Not to Scale)



BULKHEAD MOUNTING HOLES FOR IS-CT/PT FEMALE CONNECTORS

(Not to Scale)

DEFINITION OF TERMS

■ **BI-PHASE**
Found as a feed to most U.S. homes. Derived from a center tapped transformer, it contains two hot phases (180°) and the center tapped is the neutral return which is earth-grounded.

■ **CAPACITANCE**
Measured at 1 kHz unless otherwise stated.

■ **CLAMP**
To clip. Turn-on voltage is held as current is increased. Turn-on voltage is the same or nearly the same as "on" voltage drop.

■ **CLAMPING RATIO**
The ratio of voltage drop at a given current to the turn-on voltage.

■ **CLAMPING SPEED**
Measured with full lead length using a 1 kV/ns waveform in a 50Ω system, with ≥300 MHz or larger bandwidth.

■ **COATED**
Dipped in a clear high solids acrylic lacquer for weather suitability - not necessarily perfectly water tight.

■ **COMBINER**
The summation of signals into one transmission line. The peak voltage from each signal will be added together but they will be higher than just the sum of the power would indicate.

■ **COMMON MODE**
With reference to ground.

■ **COULOMB**
Measurement of charge. Often used to indicate the amount of transferred charge through a gas tube to determine gas tube life. "Q" abbreviation. Current times time.

■ **CROWBAR**
To turn-on and clamp close to ground level. Having a high turn-on trigger voltage and a low "on" voltage drop.

■ **DIFFERENTIAL MODE**
Referenced only between conductors (not referenced to ground).

■ **DIPLEXER**
(TV Broadcasting). The combining of two transmitters into one transmission line. TV visual and aural.

■ **DUPLEXER**
Simultaneous receive and transmit on one transmission line. Where a T connector splits/combines the signals to two groups of filters. The receiver filter passes the receive frequency while rejecting (band stop) the transmitter's frequency. The transmitter filter passes its frequency while attenuating the Class C transmit noise at the receive frequency.

■ **EMI/RFI**
Electro Magnetic Interference/Radio Frequency Interference. Broad spectrum noise or interfering signals.

■ **EMP**
Electro Magnetic Pulse, usually referred to as the man-made generation by detonation of a nuclear bomb at a high altitude, which generates a very fast pulse (RF) which can be captured by antennas and long unshielded lines. Sometimes referred to as NEMP, HEMP, etc. Lightning can also generate an EMP near the event. Referred to as LEMP.

■ **EMP RATED**
Rated as having a fast enough turn-on time or filtering to protect against the effects of an EMP event.

■ **FARADAY SHIELD**
An electrostatic (E field) shield made up of a conductive or partially conductive material or grid. A Faraday cage or screen room is effective for protecting inside equipment from outside radiated RF energies.

■ **FILTERING (EMI/RFI)**
Measured in a 50 Ω system - loaded. As per MIL-STD-220.

■ **FREQ. RANGE**
The bandwidth over which both the listed maximum VSWR and Insertion Loss specifications are valid.

■ **GROUND IMPEDANCE**
The ground resistance and the inductance/ capacitance value of the grounding system. Also called dynamic surge ground impedance, and must be measured by using a dynamic ground tester.

■ **GROUND RESISTANCE**
The resistance value of a given ground rod or grounding system as measured, usually by a fall of potential (3 stake) method.

■ **HF**
High Frequency — normally from 3 to 30MHz, however in this catalog it covers from 1.5 to 30MHz.

■ **HOUSED USE ONLY**
For indoor use, or must be further enclosed or waterproofed for outdoor usage.

■ **IMPEDANCE**
Nominal impedance of the device. The variation of this impedance with frequency is measured as VSWR.

■ **IN-LINE**
Power or signal passage through unit. In series with line. Usually a multi-stage protector. Best protection method.

■ **INSERTION LOSS**
The worst case loss of the device across the stated frequency range. The loss due to the insertion of the unit in series with a signal path.

■ **JOULES**
A unit of energy. One Joule for one second is equal to one watt of power. Current times time times voltage.

LEAKAGE CURRENT
Usually measured at 50 or 60 Hz with 120, 240 or 480 volts ac. However, it can be ac or dc at a specific voltage and frequency.

LOOP RESISTANCE
Total resistance as measured across the input with the output shorted.

MAX PEAK LET-THROUGH VOLTAGE
Measured at a given surge current using a given waveform, and using ≥300 MHz bandwidth across a 50 Ω impedance. (Note: this 50 Ω impedance may be dc blocked [large bandwidth compared to the surge frequencies present] and 50 Ω resistive load [termination]).

MAX. POWER
Continuous transmit power (CW).

MAX. SURGE
The maximum single surge current and specified waveform that can be handled by the device without failure during the conduction of that waveform and which ends the life of the device for conducting successive waveforms, but does not allow any generation of outward projectiles.

MULTI-STRIKE CAPABILITY
In most applications current sharing will occur, and in a direct strike event the unit will survive to work again.

RECEIVER MULTICOUPLER
Sometimes with an amplifier this device has one antenna line and multiple outlets.

RF
Radio Frequencies - any and all frequencies that can be radiated as an electromagnetic wave (plane wave).

SAFETY GROUND
The local earth ground. The earth ground which grounds the neutral return. It may be green or bare and can be via a metal conduit. It may be earth grounded as many times as needed. (Neutral must only be grounded once at the entry location).

SHF
Super High Frequency — from 3000MHz to 30GHz.

SHUNT
Line-to-ground. No power or signal passage through unit. Not in-series with line.

SINGLE PHASE
A true single phase supply. Usually a two-wire system with one hot phase and a neutral return. A safety earth ground is also present.

SKIN EFFECT
The gradient conduction and propagation of RF or RF components of a surge on the outer surfaces of conductors.

TEMPERATURE
The extremes of operating or storage that the unit or unit parts have been tested to under MIL-STD-202 for thermal shock.

THREE PHASE
Invented by Nikola Tesla which beat Edison's distribution system. It consists of Poly-Phases 120° apart on at least three wires (Delta) and often four wires (Wye). The fourth wire is a grounded neutral return. In a Delta system there is no reference to ground and thus it is more susceptible to lightning problems.

THROUGHPUT ENERGY
The total energy that will be let through the device using the indicated surge waveform.

TOTAL SURGE ENERGY
Total sum of surge energy for all lines of a protector unit. Measured in Joules. The minimum total energy which just results in the failure of the unit.

TRANSFER IMPEDANCE
Referring to coax, is the impedance to transfer into or outside the coax at various frequencies usually below 1 MHz. Due to loss of skin effect attenuation or shielding at these low frequencies, coax can be susceptible to interference and noise as well as the radiation of such signals.

TURN-ON TIME — GAS TUBE
The time between when the ramp voltage just exceeds the dc turn-on voltage of the device and the point at which 50% of the peak voltage is achieved during the turn-on (crowbar) process. Measured in a 50 Ω system with ≥300 MHz bandwidth.

TURN-ON VAC
The maximum ac sine wave voltage that can be passed with the peaks just at the turn-on Vdc level.

TURN-ON VDC
Turn-on voltage at 1mA dc with a ramp of 100v/ms typical or as tested with a PolyPhaser F.I.S.T. or F.I.S.T.-4 meter.

UHF
Ultra-High Frequency — normally from 300 to 3000MHz however in this catalog we breatout the 800 to 1000MHz separately even though it is within this category.

VHF
Very High Frequency — from 30 to 300MHz.

VSWR
Worst case Voltage Standing Wave Ratio (VSWR) of the device across the stated frequency range. VSWR is the amount of reflected signal due to an impedance mismatch.

V_T MAX
The max peak voltage of all combined waveforms. Used for multi-coupled or combined transmit signals.

TERMS AND CONDITIONS OF SALE

1. ORDERING GOODS. All orders for goods must be made or confirmed in writing. PolyPhaser's acceptance of any order shall occur only after receipt of Purchaser's written order or confirmation *and* PolyPhaser's delivery of written confirmation to Purchaser.

2. PRICES. Unless otherwise quoted in a firm offer, all prices shall be as described in PolyPhaser's price list last published before PolyPhaser's receipt of Purchaser's written order or confirmation. PolyPhaser shall provide firm quotes only in writing. Unless otherwise specified, all firm quotes shall expire thirty (30) days from date of issuance. Prices are subject to change at any time without notice. Prices do not include federal, state or local taxes, freight or insurance.

3. TERMS. Domestic sales on account are net thirty (30) days upon previously approved credit only. All other sales shall be cash or MasterCard/Visa, prepaid before shipping or COD. International sales shall be prepaid or payment guaranteed by Irrevocable Letter of Credit, all bank charges paid by Purchaser. Purchaser may purchase goods on account or credit only after approval by PolyPhaser's Credit Department.

4. DELIVERY AND SHIPPING. Unless otherwise requested in writing before shipment,

(1) All domestic orders shall be shipped (a) prepaid, insured FOB destination, UPS Ground Service; or (b) COD or on account, FOB PolyPhaser's factory, Minden, Nevada; and

(2) All international orders shall be shipped insured air delivery freight collect via carriers serving Reno/Cannon International Airport. Except air delivery freight collect, all freight and insurance charges shall be payable by Purchaser (in addition to the purchase price for the goods) in accordance with the paragraph on TERMS above. Except goods shipped FOB destination, Purchaser bears the risk of all loss or damage to goods in transit, and must make any claim for damage or loss during shipment directly with the carrier. Identification of goods shall occur when PolyPhaser places the goods in the custody of carrier for shipment.

5. INSPECTION AND ACCEPTANCE. All claims for damages, errors, shortages or non-conformance of goods must be made to PolyPhaser in writing within thirty (30) days of Purchaser's receipt of the goods. Purchaser's failure to make such claim within the time permitted shall constitute Purchaser's irrevocable acceptance of the goods.

6. MODIFICATIONS. PolyPhaser reserves the right to modify and change specifications with respect to any goods without notice, and to substitute such modified goods to the extent that they meet or exceed the performance specifications of the goods ordered by Purchaser.

7. RETURNS AND ALLOWANCES. Goods rejected by Purchaser for damage (other than during shipping) or non-conformance must be returned to PolyPhaser within thirty (30) days of Purchaser's timely rejection thereof. All other returns, whether for warranty or otherwise, may be returned only after written notice given by Purchaser to PolyPhaser and written authorization and acceptance by PolyPhaser. Purchaser shall ship all returned goods insured freight collect by carrier designated by PolyPhaser. Credit or adjustment for returned goods shall be subject to inspection and acceptance by PolyPhaser at PolyPhaser's factory, Minden, Nevada. Non-standard catalog items and items specially manufactured for Purchaser are non-returnable, non-refundable except as to warranty defects and non-conformance to manufacturing specifications.

8. LIMITED WARRANTY. POLYPHASER WARRANTS THAT AT THE TIME OF SHIPMENT THE GOODS SHALL MEET OR EXCEED ALL OF POLYPHASER'S PUBLISHED SPECIFICATIONS FOR SUCH GOODS AND SHALL BE AND REMAIN FREE OF DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD ENDING TEN (10) YEARS AFTER THE DATE OF SHIPMENT OF THE GOODS TO PURCHASER. PURCHASER AGREES THAT THE GOODS ARE DESIGNED ACCORDING TO SPECIFICATIONS SUITABLE FOR PURCHASER'S PURPOSES, AND THAT, EXCEPT AS SET FORTH IN THIS LIMITED WARRANTY, POLYPHASER DISCLAIMS ANY WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY AS TO THE DESIGN, FITNESS, CONDITION, MERCHANTABILITY OR DESCRIPTION OF OR AS TO THE QUALITY OF THE MATERIAL OR WORKMANSHIP IN THE GOODS, OR AS TO THEIR FITNESS FOR ANY PARTICULAR PURPOSE FOR ANY TRADE OR BUSINESS, OR ANY OTHER REPRESENTATION OR WARRANTY WHATSOEVER. Also excluded from this limited warranty are goods covered by other written manufacturer or supplier warranties, damage resulting from ordinary wear and tear, abusive use or lack of proper maintenance, work not done by PolyPhaser or PolyPhaser's contractor or agents, or loss or injury caused by the elements or during shipment to or from Purchaser. Purchaser agrees to notify PolyPhaser in writing within thirty (30) days of Purchaser's discovery of any problem with any goods subject to this limited warranty. Goods determined to be defective in materials or workmanship within the time described in this Limited Warranty shall be repaired, replaced, or price fully refunded at PolyPhaser's sole discretion, and only after Purchaser's full compliance with the terms of RETURNS AND ALLOWANCES above, PolyPhaser's written approval for return, and examination by PolyPhaser at PolyPhaser's factory. PolyPhaser shall notify Purchaser of its decision to repair, replace, refund the purchase price, or to deny liability under this Limited Warranty within sixty (60) days of PolyPhaser's receipt of the returned goods. The warranties contained in this Limited Warranty are personal to Purchaser and are not assignable by Purchaser to any transferee of the goods.

9. LIMITATION OF LIABILITY. PolyPhaser shall not under any circumstances (a) be liable to Purchaser for any warranty claim relating to the goods or components that Purchaser asserts more than ten (10) years after the date of shipment of the goods to Purchaser; (b) be liable to Purchaser for any damages in excess of the amount actually paid by Purchaser to PolyPhaser for the goods as to which Purchaser makes a warranty claim or the cost of repair or replacement, whichever is the smaller amount; (3) be liable to Purchaser for any loss of use or profits or other special or consequential damages; or (4) be responsible for any personal injury, or property damage alleged to arise as a result of Purchaser's or any third party's use of the goods. Purchaser expressly assumes the risk of and the responsibility for any and all damages for personal injury, property damage, loss of use or profits or other special or consequential damages relating in any way to the goods or use thereof. The above limitation shall apply even though it may be alleged that PolyPhaser or its agents have been actively or passively negligent.

10. VENUE AND JURISDICTION. The sole and exclusive forum for the resolution of any disputes arising between Purchaser and PolyPhaser shall be the Ninth Judicial District Court in the State of Nevada, in and for Douglas County, or, upon proper legal basis, the United States District Court for the District of Nevada, Northern Nevada Division, and Purchaser and PolyPhaser each confers jurisdiction over the resolution of such disputes upon these courts.

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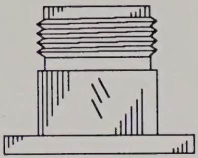
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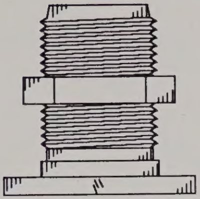
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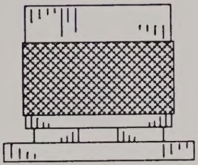
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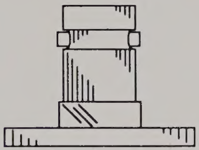
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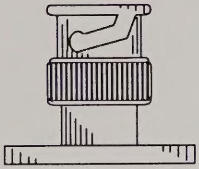
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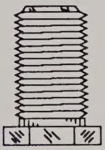
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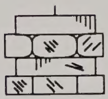
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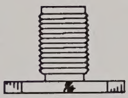
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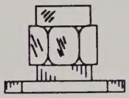
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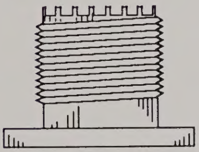
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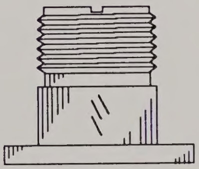
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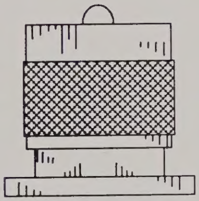
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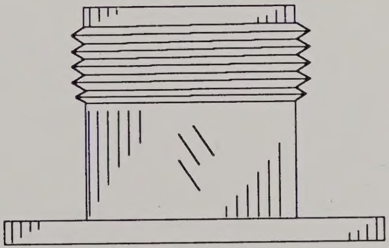
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